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RESOURCES of

TIMBER

EASTERN MONTANA

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and

FOREST SURVEY
INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

REGION 1, USDA FOREST SERVICE

Errata for Timber Resources of Eastern Montana

Table 18, page 38. The gross growth of the softwood species in all of the working circles is 2.7 percent of the total cubic-foot volume.

Table 24, page 47. The total area of commercial timberland in Eastern Montana is 1,160.6 thousand acres.

Table 30, page 60. The area of private land in Working Circle 7 is 13,733,652 acres.
The area of private land in Working Circle 8 is 14,551,382 acres.
The area of private land in Eastern Montana is 42,965,633 acres.

TIMBER RESOURCES of EASTERN MONTANA

JULY, 1984

MONTANA DEPARTMENT OF
STATE LANDS
FORESTRY DIVISION
2705 SPURGIN ROAD
MISSOULA, MONTANA 59801

and

FOREST SURVEY
INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION
REGION 1, USDA FOREST SERVICE

ABSTRACT

Timber inventory data was collected in 1977, 1979, and 1980 on forest land owned by state, county, municipal, and miscellaneous federal agencies. Previously unsampled BLM and privately owned forest lands were also included in the sample. In eastern Montana there was an estimated 1.2 million acres of commercial timberland and an additional 0.7 million acres of other forest land. Commercial timberlands had a total growing stock volume of 1.1 billion cubic feet. Sawtimber volume was estimated to be 3.0 billion board feet Scribner.

Of the commercial timberland sampled, 1.0 million acres were found to be grazable. About 69 percent of the grazable timberlands were estimated to be in good or excellent condition. The carrying capacity of the sampled commercial timberland was estimated to be 154,800 AUM's.

The average potential productivity was found to be 37 cubic feet per acre per year. About 81 percent of the timberland had the potential to produce from 20 to 49 cubic feet of wood per acre per year. Eighty-three percent of the commercial softwood timberland sampled was rated as fair for timber production. About 15 percent, or 147,000 acres, was rated as good or excellent.

The outlook for the future timber supply in eastern Montana is good. There appears to be plenty of standing volume and growth to meet the demand that has occurred historically. The annual average harvest from private land over the last 15 years is only 23 percent of the board foot net growth estimated for 1980.

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PREFACE

This publication summarizes the findings of a timber resource inventory conducted in eastern Montana (Working Circles 4, 5, 6, 7, and 8). It is the fifth and final in a series of forest inventory reports. Each report displays and analyzes inventory data for a different portion of the state. A statewide report will subsequently be published by the Intermountain Forest and Range Experiment Station in cooperation with the Montana Department of State Lands (DSL), Forestry Division.

The inventory of eastern Montana began with Working Circle 5 in November, 1976, and Working Circles 4, 6, 7, and 8 in November, 1978, under the authority of an existing cooperative agreement between the Intermountain Forest and Range Experiment Station, Region 1 of the USDA Forest Service, and the Montana Department of Natural Resources and Conservation, Forestry Division. Under the agreement, the Forestry Division, transferred to the Department of State Lands in 1981, supervised the collection of forest inventory data on all lands in eastern Montana. Land administered by the USDA Forest Service or the USDI Bureau of Indian Affairs, or previously sampled Bureau of Land Management land was not sampled. The USDA Forest Service provided technical assistance and 60 percent of the funding for the project. The state of Montana provided the remaining 40 percent.

Aerial photo interpretation in Working Circle 5 began in January, 1977, and was completed in June, 1977. Photo interpretation of Working Circles 4, 6, 7, and 8 was done from January, 1979, to February, 1980. Field data collection from the 90 forested plots in Working Circle 5 began in June and was finished in October, 1977. There were 466 forested field plots in Working Circles 4, 6, 7, and 8. Data collection on these began in June, 1979, and continued during the summer and fall months until the last plot was measured in September, 1980.

Readers should note that because the data was rounded off to reach the numbers used in this report, the column and row totals in some tables may not be the exact sum of the individual cells.

ACKNOWLEDGEMENTS

This project could not have been completed without the willing assistance of numerous groups. DSL, the Intermountain Forest and Range Experiment Station, and Region 1, Cooperative Forestry and Pest Management jointly wish to acknowledge the following agencies, organizations, and individuals for their contributions and cooperation:

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For collecting inventory data, DSL recognizes the forest inventory crew, which included: supervisor Brian Long; inventory foresters Pete Metzmaker and Bob Dillon; inventory technicians Kurt Gelderman, Mark Hannah, Jeff Rupkalvis, Randy Piearson, Steve Higgins, and Galynn Huber; and secretary Caroline Flink. For consulting, adopting, and developing special inventory procedures, DSL recognizes: Hal Hunter and Frank Kirschten of the Soil Conservation Service, and Vince Frezzo of the Forestry Division (forest land range inventory); Jeff Jahnke and Paul Klug of the DSL (silvicultural treatment opportunities inventory); Terry Lonner of the Montana Department of Fish, Wildlife, and Parks (wildlife use inventory); and Bill Fischer of the Forest Service (fuel loading inventory). DSL also recognizes: Brian Long and Bob Dillon of the Forestry Division for writing this report; Diane Smith for editing it; Brian Long, Pat Flowers, and Bob Dillon of the Forestry Division for the photographs used in this report; and the Montana Department of Administration, Publications and Graphics Bureau for helping with the graphics, layout, and printing. Earl Salmonson and Don Artley of the Forestry Division provided direction for the project.

ABBREVIATIONS

AUM	animal unit month
BAF	basal area factor
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CFL	commercial forest land
d.b.h.	diameter at breast height
DNRC	Montana Department of Natural Resources and Conservation
DSL	Montana Department of State Lands
MAI	mean annual increment
MBF	thousand board feet
MBFS	thousand board feet Scribner
MMBF	million board feet
NCFL	noncommercial forest land
NPS	National Park Service
SCS	Soil Conservation Service
USDA	U. S. Department of Agriculture
USDI	U. S. Department of the Interior
USFS	U. S. Forest Service

INTRODUCTION

Geographical Overview

Working Circle 4

At the geographic center of Montana, Working Circle 4 is bounded to the north by the Wild and Scenic Missouri River. The rugged breaks rise sharply from the river, then the terrain changes to more gently rolling hills. Charles M. Russell, "The Cowboy Artist," visited the Judith Basin area as a boy and soon made it his home. The wildlife refuge along the Missouri River has been named after him, and is the home for deer, elk, bighorn sheep, game birds, and many kinds of non-game animals. The Musselshell River flows across the southern part of Working Circle 4 before it turns north and becomes the east boundary, finally entering the Missouri at U.L. Bend. Parts of the Little Belt, Crazy, and Highwood Mountains extend into Working Circle 4. The Big and Little Snowy Mountains are near the center of the working circle, south of Lewistown. These mountainous areas are where the Forest Service ownership is concentrated. There are also the Bull, Moccasin, and Judith Mountains. The mountains, National Forest land, and various recreation areas and wildlife refuges offer opportunities for many kinds of activities. There are 13 small sawmills in Working Circle 4, and five post and pole processors.

Working Circle 5

The smallest working circle in Montana, Working Circle 5, is made up of only two counties: Carbon and Stillwater. The Beartooth Mountains are the highest in the state, and cover the southwest part of the working circle. The Yellowstone River flows east across both counties, and is joined by the Clarks Fork of the Yellowstone, which flows north through Carbon County. Most of Working Circle 5 is typical of eastern Montana with hot, dry summers that limit tree growth. In southern Carbon County, the Pryor Mountains are a surprising break in the landscape. The Ice Caves, caves naturally lined with ice year-round, are a fascinating phenomenon. The Pryor Mountains Wild Horse Range was established in 1968, and now has a herd of about 130 horses. Only one small sawmill operates in Working Circle 5, and a post and pole processor.

Working Circle 6

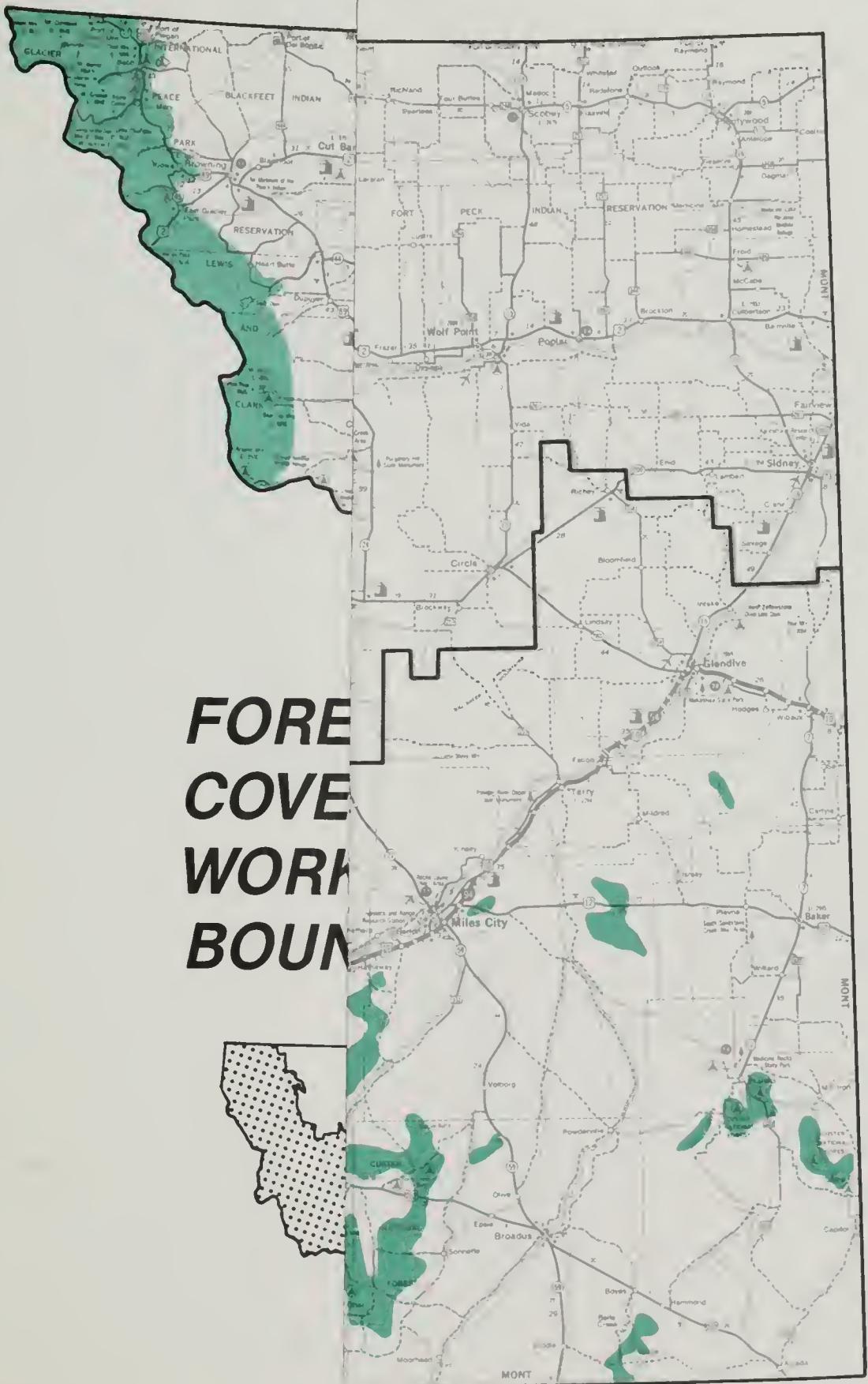
Working Circle 6 is in the northwest part of the area covered by the report. It reaches the Canadian border to the north and into Glacier National Park. The western boundary follows the Continental Divide from Canada to the North Fork of the Sun River. The Blackfeet Indian Reservation covers a large area east of the park and south of Canada, and part of the Rocky Boys Indian Reservation is in northeastern Chouteau County. The Great Falls of the Missouri River forced the Lewis and Clark Expedition into an 18-mile portage, which took them 15 days to complete. The town of Great Falls grew up along the river, and is now the second largest city in the state. Ryan Dam now stands at the site of the falls. Near the falls is Giant Springs State Park, the location of one of the largest fresh water springs in the world. It was discovered by Lewis and Clark in 1805, and flows at a rate of 338 million gallons per day. From 1860-1887, Fort Benton was the most prominent town in the settlement of Montana. As a trading post, a military fort, and the upper end of steamboat navigation, it was an important overland connection. The demands for transportation of settlers and fortune seekers, as well as for the goods and supplies they needed, made the potential profit of taking a steamboat up the river worth the risk. Currently in Working Circle 6 there are three small sawmills and two post and pole processors.

Working Circle 7

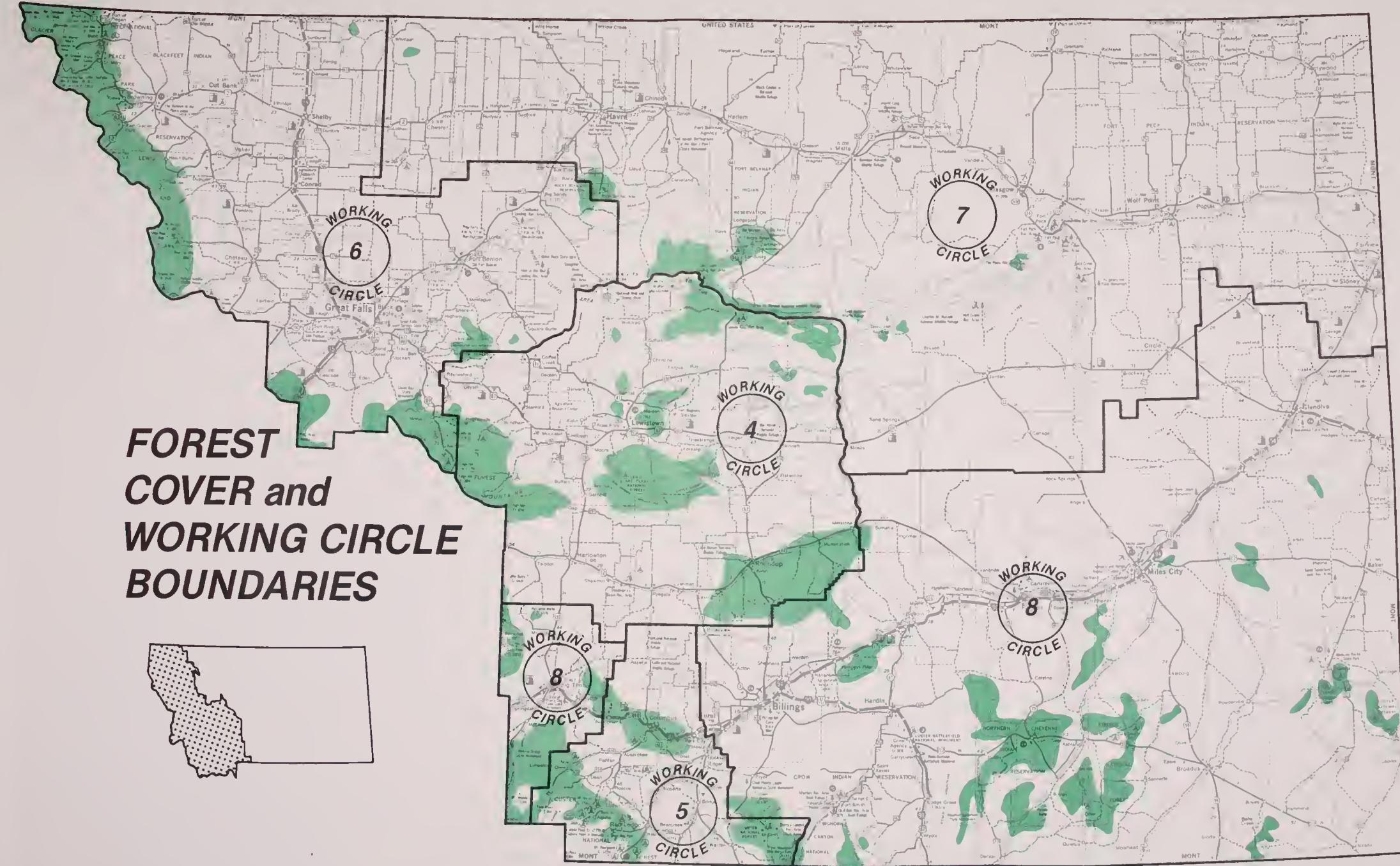
Bordering on Canada and North Dakota in north central and northeast Montana, Working Circle 7 is the largest working circle in the state. The wide prairies are used by farmers and ranchers, as well as being the home of many kinds of wildlife. Some of the animals are permanent residents, while many species of waterfowl migrate through, taking advantage of the wildlife refuges and the other areas of naturally favorable habitat. The topographical features providing the most relief are the Bear Paw Mountains, the Little Rocky Mountains, and the breaks along the Missouri River. One of the world's largest earth-filled dams impounds the river at Fort Peck, forming the fourth largest reservoir on earth with a length of 189 miles and 1600 miles of shoreline. Just south of Havre, along the Highline, is Beaver Creek Park, the largest county park in the country. The only wood processor in the working circle is a post and pole manufacturer.

Working Circle 8

The most mountainous terrain in Working Circle 8 is found in Sweet Grass County, with the Beartooth Mountains in the south and the Crazy Mountains in the northwest. The Yellowstone River, the longest free-flowing river in the country, angles across the working circle. Most of the bigger towns and cities are along the river, as is Billings, the biggest city in the state. A few miles south of Billings, Pictograph Cave State Monument preserves the remains of a prehistoric culture 5000 years old. Not far downstream is Pompey's Pillar. In 1806, on the way home, Captain William Clark carved his signature on this massive 150-foot sandstone block, leaving the only remaining physical evidence of the Lewis and Clark Expedition. Further downstream, near Glendive, is Makoshika State Park. Named by the Sioux Indians, it means "Bad Land"; apparently the site impressed them greatly with all the weird rock shapes. Just north of Ekalaka is Medicine Rocks State Park, another place that played a part in Indian culture. Hunting parties went there for the benefits of the "Big Medicine." Not far south of the present location of Hardin is the Custer Battlefield National Monument. This is the site of the battle on June 25, 1876, between the Sioux and Cheyenne Indians and the U.S. Cavalry. The area is now in the Crow Indian Reservation, the largest in the state. Another point of interest on the reservation is the Bighorn Canyon National Recreation Area, where the 500-foot Yellowtail Dam creates Bighorn Lake on a section of the border with Working Circle 5. The Northern Cheyenne Indian Reservation is also in Working Circle 8. There are ten small sawmills and a post and pole producer in the working circle.



FOREST COVER and WORKING CIRCLE BOUNDARIES



Forest Types

A description of each forest type sampled in eastern Montana follows. These descriptions may not be the same for all areas of the state.

Because more than one tree species can occur within a given forest type, those species that exhibited the largest number of live trees (plurality of stocking) at a sampled location determined the forest type. Individual trees were ranked according to their relative dominance in the plot. In those cases where trees had overstocked a site, smaller or less-dominant trees were not counted. Unless a stand of trees was lightly stocked with poletimber or sawtimber, seedlings and saplings were seldom considered when designating a forest type.



Ponderosa Pine Type

Important Statistics

CFL Area (thousand acres)	Percent of CFL Total
805.8	69.4
Net Volume	
654,193 Mft ³	57.5
1,679,683 MBFS	55.9

Much of eastern Montana has a low-elevation forest belt of ponderosa pine (Pinus ponderosa variety scopulorum). In contrast to westside ponderosa pine (P. ponderosa variety ponderosa), these have many two-needle fascicles and a short growth form (Arno 1979). The ponderosa pine forest type covers more than two-thirds of the commercial timberland and has more than half of the volume in eastern Montana. Only in Working Circle 6 does another forest type, Douglas-fir, have more area and volume. The absence of the ponderosa pine forest type in north-central and northeast Montana is apparently due to frigid arctic winds. Ponderosa pine is responsible for 96 percent of the cubic foot volume on the ponderosa pine forest type. Its most common associates are Douglas-fir (Pseudotsuga menziesii variety glauca), lodgepole pine (Pinus contorta variety latifolia), and limber pine (Pinus flexilis), but ponderosa pine is generally found in pure stands in eastern

Montana. The ability of ponderosa pine seedlings to send down a vigorous taproot enables it to survive on severe sites where its associates often fail (USDA Forest Service 1965).



Douglas-fir Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
163.9	14.1
Net Volume	
241,706 Mft ³	21.2
680,530 MBFS	22.6

The Douglas-fir forest type is found in most of the mountain ranges in eastern Montana, as well as in some of the hillier areas and many sheltered drainages with good soil development. Some other sites are moist enough to support this type but are too isolated from potential Douglas-fir seed sources. Ponderosa pine and lodgepole pine are fairly major components of the type, but Douglas-fir makes up 74 percent of the volume. Every commercial tree species in eastern Montana can be found on the Douglas-fir forest type.



Lodgepole Pine Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
37.3	3.2
Net Volume	
70,138 Mft ³	6.2
106,933 MBFS	3.6

The lodgepole pine forest type usually grows in areas moister and cooler than those dominated by Douglas-fir or ponderosa pine, but too dry and warm for spruce (Picea species) or subalpine fir (Abies lasiocarpa) (USDA Forest Service 1965). Ninety percent of the cubic foot volume on the lodgepole pine forest type is lodgepole pine. Douglas-fir is the most common associate in eastern Montana, and the only other growing stock species tallied except in Working Circle 6.



Juniper Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
3.5	0.3
Net Volume	
155 Mft ³	*
458 MBFS	*

The juniper forest type is found on dry, rocky sites over a wide range of elevations. Most juniper (Juniperus scopulorum or J. osteosperma) stands are found on sites that are not capable of producing 20 cubic feet of wood per acre per year under natural conditions. In some parts of the state, juniper is used for fence posts and firewood. The volume shown for each forest type, however, does not include juniper because it is not considered a commercial species in Montana. The only place in eastern Montana where commercial species were inventoried on the juniper forest type was in Working Circle 5. Those species were either whitebark pine (Pinus albicaulis) or limber pine.

*Indicates less than 0.05%.



Whitebark-Limber Pine Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
2.3	0.2
Net Volume	
323 Mft ³	*
610 MBFS	*

This forest type actually represents two very different topographic and climatic extremes. The whitebark pine forest type occurs at the upper elevational limits of commercial timberland. The trees are long lived and slow growing, and frequently live longer than 400 years.

The limber pine forest type can be found on some of the driest sites capable of supporting trees (Pfister et al. 1977). This forest type was found growing just above the grasslands and at mid- to upper-elevations on steep, dry, rocky mountain slopes.

In eastern Montana the only associated commercial species recorded was ponderosa pine. Eighty percent of the volume is whitebark or limber pine on the whitebark-limber pine forest type. This forest type is not an important timber producer.

*Indicates less than 0.05%.



Spruce Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
0.8	0.1
Net Volume	
3,891 Mft ³	0.3
8,111 MBFS	0.3

In Montana, the most common species of spruce is Engelmann spruce (Picea engelmannii), although in many stands Engelmann spruce has hybridized with white spruce (P. glauca). Occasionally a stand containing white spruce can be found (Pfister et al. 1977).

The spruce forest type was found in moist to wet areas with cool to cold climates. Spruce is commonly found growing in cool ravines, along streams and lakes, or in areas with a high water table. The tree species most often found growing with spruce in eastern Montana was whitebark pine. Spruce makes up 47 percent of the cubic foot volume on the spruce forest type.



Cottonwood Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
115.1	9.9
Net Volume	
129,237 Mft ³	11.4
493,289 MBFS	16.4

Stands of cottonwood (Populus trichocarpa and P. deltoides) are scattered along rivers and streams throughout eastern Montana. Most of the stands sampled were made up almost entirely of cottonwood; it is responsible for 99 percent of the cubic foot volume. Although this type is not an important timber producer, the wood was used extensively for fuel by steamboats on the navigable rivers, and cottonwood stands now serve an important role in maintaining river and stream bank stability.



Aspen Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
29.7	2.6
Net Volume	
36,533 Mft ³	3.2
29,107 MBFS	1.0

Aspen (Populus tremuloides) stands usually occur on moist sites adjacent to or among conifer stands. The most commonly associated species were lodgepole pine and Douglas-fir, but aspen made up 76 percent of the cubic foot volume.

Periodic wildfires seem necessary for aspen stands to perpetuate (Pfister et al. 1977). In areas where wildfires have been successfully suppressed, aspen stands seem to be succeeding towards conifer stands.

Aspen is not an important commercial species in eastern Montana, but there has been some recent experimentation in using aspen as feed for cattle.



Mixed Hardwoods Type

Important Statistics

CFL Area (thousand acres)	Percentage of CFL Total
2.3	0.2
Net Volume	
2,344 Mft ³	0.2
6,303 MBFS	0.2

The mixed hardwoods forest type is most often composed of pure or mixed stands of box elder (Acer negundo), green ash (Fraxinus pennsylvanica), American plum (Prunus americana), or peachleaf willow (Salix amygdaloides). It is found in moist ravines or bottom lands in isolated areas of eastern Montana. Cottonwood was sometimes found on this type, but other hardwoods constitute 89 percent of the cubic foot volume.

The mixed hardwoods type is not commercially important in Montana.

Inventory Procedures

Forest inventory data was collected on all private, state, county, municipal, and some miscellaneous federal lands in the working circle. These miscellaneous federal lands included USDI Fish and Wildlife Service lands, lands within national monuments, and lands controlled by the U.S. Army Corps of Engineers and the USDI Bureau of Reclamation. Forest inventory data was also collected on previously uninventoried portions of Bureau of Land Management lands. These BLM lands occurred in Working Circles 4, 7, and 8. The remaining BLM land, USDA Forest Service, USDI Bureau of Indian Affairs, and National Park Service lands were not sampled. The total sampled area was 53.5 million acres which included forest and nonforest land.

Sample points were selected, measurements taken, and data analyzed through the following methods:

1. Initial area estimates were based on the classification of 355,300 sample points systematically placed on the best base maps available.

Forested sample points were transferred to the latest aerial photographs available. The dates of these photos ranged from 1956 to 1978. The sample points were summarized and grouped into strata for subsequent field sampling. The sample points, adjusted to meet known land areas, were used to compute area expansion factors for the field stratum means.

2. Land classification and estimates of timber characteristics and volume were based on observations and measurements recorded at 541 ground sample locations. Sample trees were selected using a 10-point cluster that included fixed plots (1/300 acre) for trees less than 5.0 inches d.b.h. and variable plots (40 BAF) for trees 5.0 inches d.b.h. or larger.

3. All photo and field data was sent to the Intermountain Experiment Station in Ogden, Utah, to be punched onto computer cards and stored for machine computing, sorting, and tabulation. Computerized edits were sent to the inventory crew for corrections. Final estimates were based on statistical summaries of the data.

Data reliability is listed in Appendix 1.

MAJOR INVENTORY FINDINGS

The Timber Resource

The total sampled area was 53.5 million acres of which 1.2 million acres (2 percent) were classified as commercial timberland. There were another 0.6 million acres of forest land classified as unproductive. About 81 percent of the sampled commercial timberland was owned by the other private ownership group. Ponderosa pine was found to be the dominant forest type, covering 69 percent of the commercial timberland. Growing stock net volume was estimated to be 1.1 billion cubic feet and sawtimber volume was estimated to be 3.0 billion board feet Scribner. Annual growing stock net growth totaled 26.2 million cubic feet and sawtimber totaled 88.7 million board feet. Annual mortality was estimated to be 4.3 million cubic feet or 9.1 million board feet. The average acre of commercial timberland had the potential to produce 37 cubic feet per acre per year. About 81 percent of the timberland had the potential to produce from 20 to 49 cubic feet per acre per year.

Area By Ownership Group

Table 1 shows the acreage and percentage of land in eastern Montana owned or administered by the different owners. As this table shows, public agencies owned or administered 31 percent of the land. The USDI Bureau of Land Management administered the largest portion of this public land.

The proportion of the sampled lands -- private, state, county, municipal, USDI Bureau of Land Management and miscellaneous federal -- owned or administered by different ownership groups is shown in Figure 2. The total sampled area was 53.5 million acres which included nonforest land as well as forest. The total estimated forest land area was 1,869,300 acres. The commercial timberland component was estimated to total 1,160,600 acres or 62 percent of the forest land (see Table 2).

Of the commercial forest land sampled, about 81 percent, or 940,100 acres, was owned by farmers and ranchers (see Table 2). Another six percent was owned by other private owners. The Montana Department of State Lands owned an additional seven percent of the commercial timberland sampled (see Figure 3).

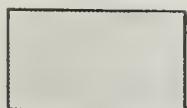
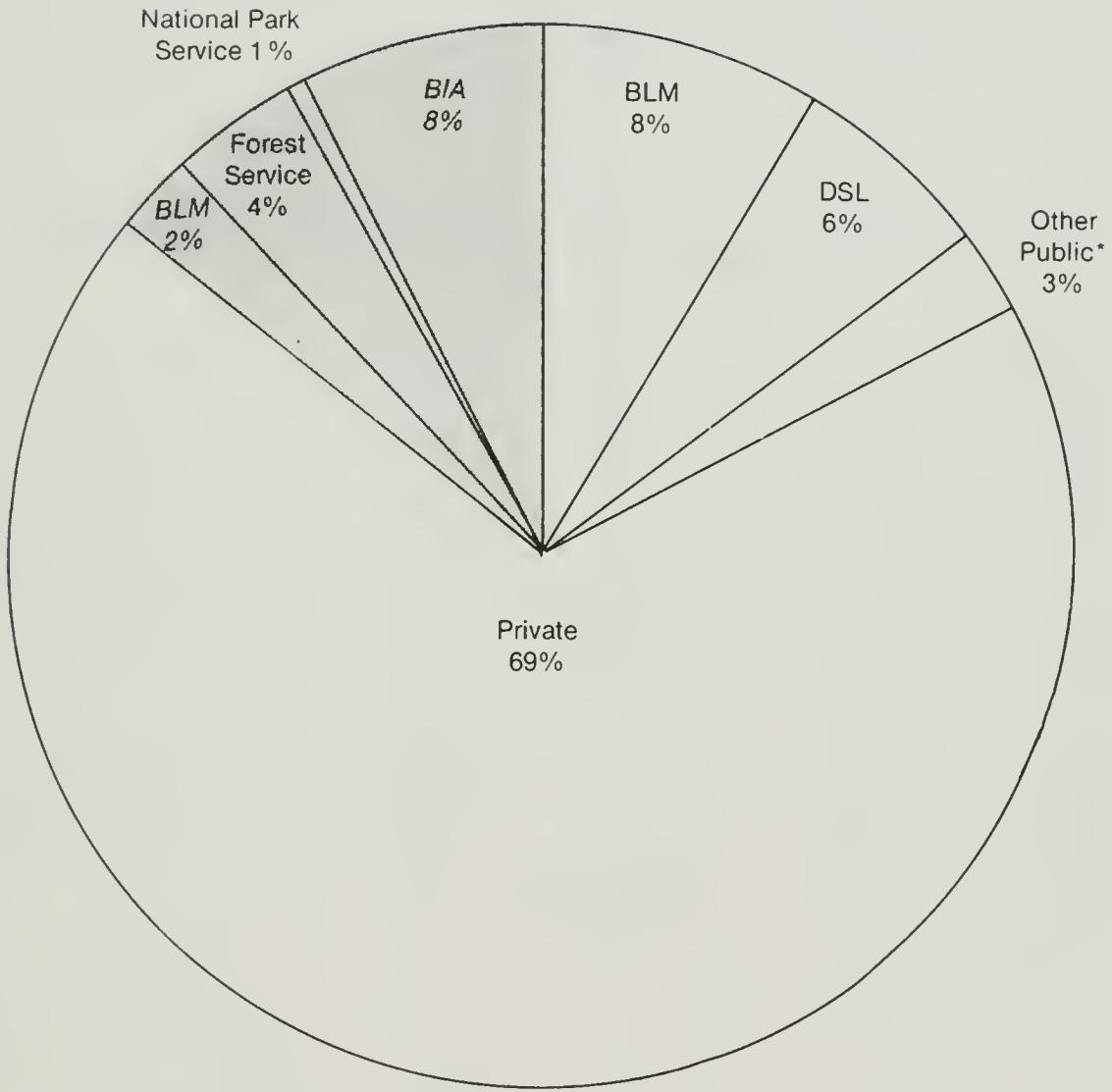
Table 1. Total land area by owner, Working Circles 4, 5, 6, 7, and 8 (acres).

Owner	Acreage	Percentage of Total
Public:		
USDA Forest Service	2,384,597	3.8
USDI Bureau of Land Management	6,762,183	10.8
USDI Bureau of Indian Affairs	4,602,425	7.4
USDI National Park Service	460,292	0.7
Miscellaneous Federal	1,242,136	2.0
State	3,910,743	6.3
County and Municipal	98,972	0.2
Subtotal	19,461,348	31.2
Private:	42,965,633	68.8
Total Land Area	62,426,981	100.0

Table 2. Area of commercial timberland and other forest land by owner, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Owner	Commercial Timberland	Other Forest Land	All Forest Land	Percentage of Total
Public:				
Montana Department of State Lands	79.5	49.9	129.4	6.9
Other State	5.3	0.7	6.0	0.3
Miscellaneous Federal	1.3	1.7	3.0	0.2
County and Municipal	1.3	0.2	1.5	0.1
BLM	67.6	81.7	149.4	8.0
Subtotal	155.1	134.2	289.3	15.5
Private:				
Farmer/Rancher	940.1	545.3	1,485.3	79.5
Other Private - Corporate	36.0	20.5	56.5	3.0
Other Private - Individual	29.4	8.8	38.2	2.0
Subtotal	1,005.4	574.6	1,580.0	84.5
Total	1,160.6	708.7	1,869.3	100.0

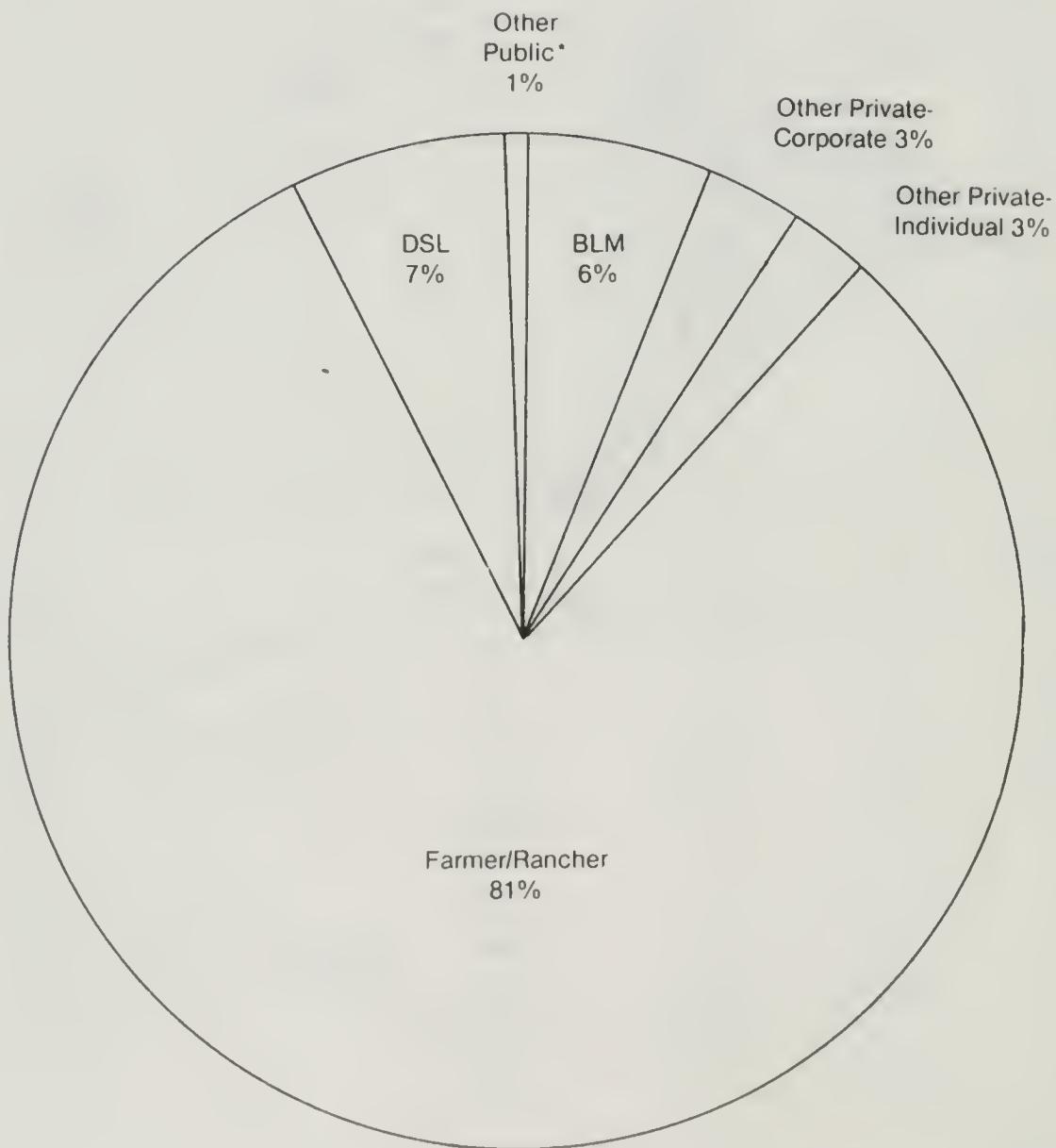
Figure 2. Proportion of the total area, sampled and nonsampled, by owner, Working Circles 4, 5, 6, 7, and 8.



Nonsampled land

*Includes other state, miscellaneous federal, and county and municipal land.

Figure 3. Proportion of the sampled commercial timberland area by ownership class, Working Circles 4, 5, 6, 7, and 8.



*Includes other state, miscellaneous federal, and county and municipal land.

Forest Type Acreage

The ponderosa pine forest type comprised 69 percent of the commercial timberland acreage (see Table 3). Douglas-fir and cottonwood forest types together comprised 24 percent of the commercial acreage. All other forest types listed in Table 3 were very minor components of the commercial forest.

Table 3. Area of commercial timberland by forest type and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand acres-----				
Ponderosa pine	117.7	688.0	805.8	69.4
Douglas-fir	14.6	149.2	163.9	14.1
Lodgepole pine	4.1	33.2	37.3	3.2
Juniper	0.2	3.2	3.5	0.3
Whitebark-limber pine	0.1	2.2	2.3	0.2
Spruce	-	0.8	0.8	0.1
Softwood types	136.9	876.6	1,013.5	87.3
Cottonwood	13.6	101.5	115.1	9.9
Aspen	4.5	25.2	29.7	2.6
Mixed hardwoods	0.2	2.1	2.3	0.2
Hardwood types	18.3	128.8	147.1	12.7
All forest types	155.1	1,005.4	1,160.6	100.0

Volume Estimates

The ponderosa pine, Douglas-fir, and cottonwood forest types contained 90 percent of the total growing stock cubic foot volume and 95 percent of the total sawtimber board foot volume occurring on sampled land in eastern Montana (see Tables 4 and 5).

About 88 percent of the total sampled volume belonged to owners in the other private ownership group. This percentage applies to both cubic foot and board foot volumes.

The volume by species is shown in Tables 6 and 7. Ponderosa pine and Douglas-fir made up 76 percent of the cubic foot and board foot volume in eastern Montana.

The average volume per acre for all sampled lands was estimated to be 2,600 board feet Scribner.

Table 4. Net volume of growing stock on commercial timberland by forest type and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand cubic feet-----				
Ponderosa pine	91,191	563,002	654,193	57.5
Douglas-fir	20,340	221,365	241,706	21.2
Lodgepole pine	7,454	62,684	70,138	6.2
Juniper	9	146	155	*
Whitebark-limber pine	19	303	323	*
Spruce	-	3,891	3,891	0.3
Softwood types	119,014	851,391	970,405	85.2
Cottonwood	15,186	114,051	129,237	11.4
Aspen	5,694	30,839	36,533	3.2
Mixed hardwoods	186	2,158	2,344	0.2
Hardwood types	21,066	147,048	168,114	14.8
All forest types	140,080	998,439	1,138,519	100.0

*Indicates less than 0.05 percent.

Table 5. Net volume of sawtimber on commercial timberland by forest type and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand board feet-----				
Ponderosa pine	235,565	1,444,118	1,679,683	55.9
Douglas-fir	55,915	624,616	680,530	22.6
Lodgepole pine	8,131	98,802	106,933	3.6
Juniper	27	430	458	*
Whitebark-limber pine	37	573	610	*
Spruce	-	8,111	8,111	0.3
Softwood types	299,674	2,176,650	2,476,324	82.4
Cottonwood	57,999	435,290	493,289	16.4
Aspen	6,715	22,392	29,107	1.0
Mixed hardwoods	501	5,802	6,303	0.2
Hardwood types	65,216	463,483	528,699	17.6
All forest types	364,891	2,640,133	3,005,024	100.0

*Indicates less than 0.05 percent.

Table 6. Net volume of growing stock on commercial timberland by species and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand cubic feet-----				
Ponderosa pine	88,536	569,642	658,178	57.8
Douglas-fir	19,537	186,326	205,863	18.1
Lodgepole pine	9,907	72,582	82,489	7.2
Whitebark-limber pine	632	11,171	11,804	1.0
Spruce	594	10,743	11,337	1.0
Subalpine fir	27	868	894	0.1
Softwood species	119,233	851,332	970,565	85.2
Cottonwood	15,288	115,280	130,568	11.5
Aspen	5,396	29,899	35,296	3.1
Mixed hardwoods	163	1,928	2,090	0.2
Hardwood species	20,847	147,107	167,954	14.8
Total all species	140,080	998,439	1,138,519	100.0

Figure 4. Net volume of growing stock on commercial timberland by species and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

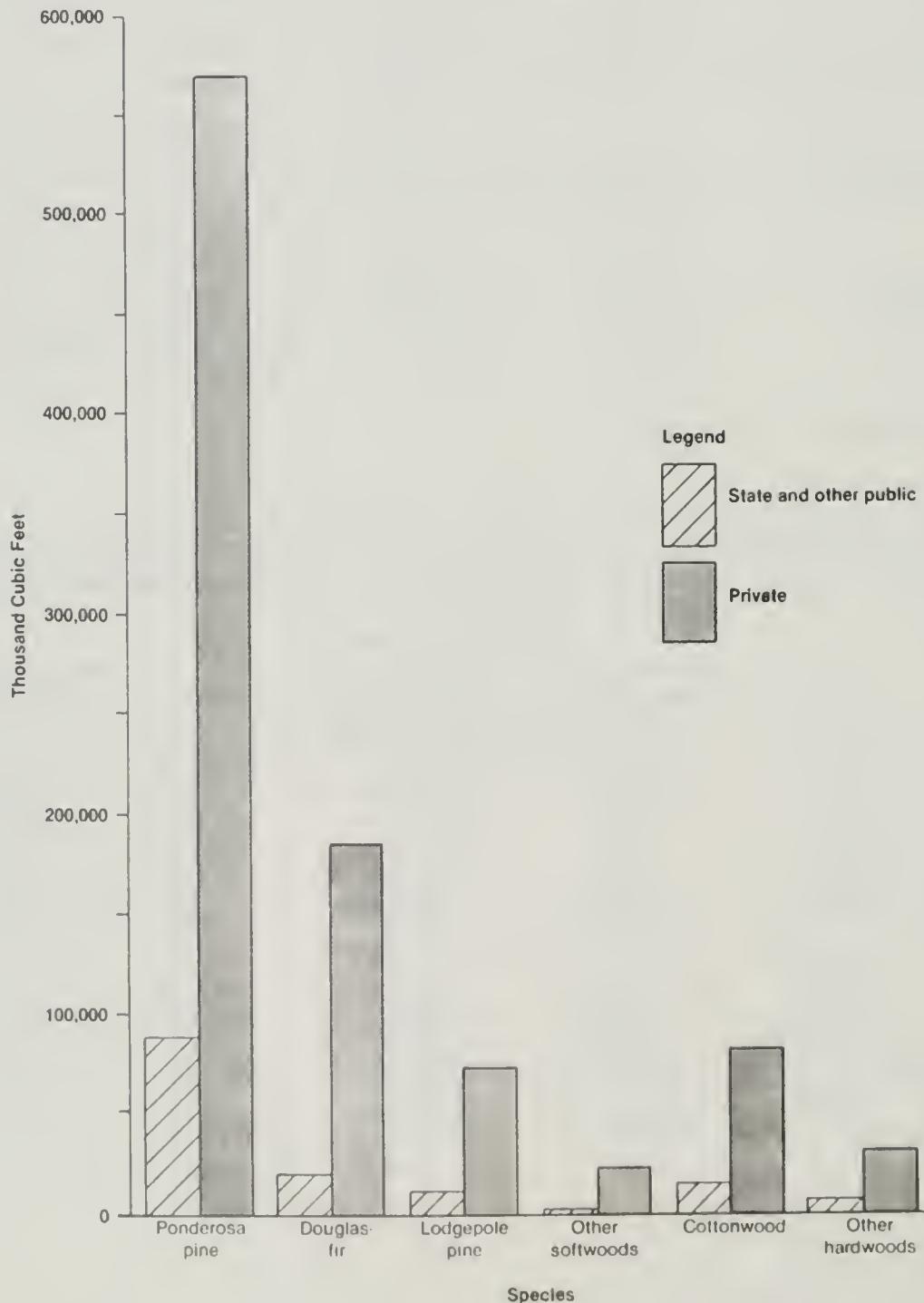


Figure 5. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

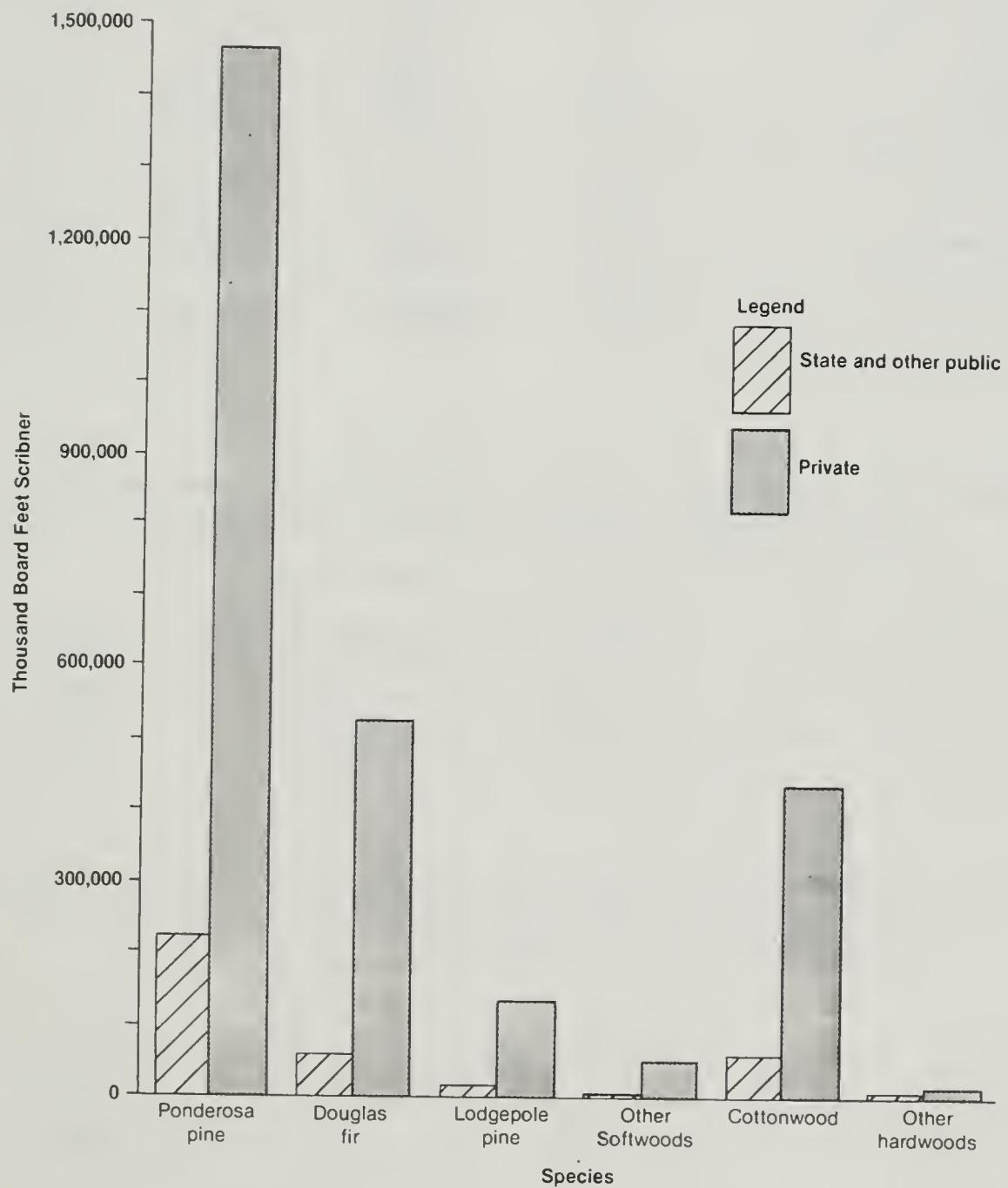


Table 7. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand board feet-----				
Ponderosa pine	227,165	1,470,213	1,697,378	56.5
Douglas-fir	56,039	527,595	583,635	19.4
Lodgepole pine	14,844	136,783	151,628	5.1
Whitebark-limber pine	1,158	18,855	20,013	0.7
Spruce	1,828	32,166	33,994	1.1
Subalpine fir	21	978	1,000	*
Softwood species	301,055	2,186,591	2,487,647	82.8
Cottonwood	58,439	440,109	498,549	16.6
Aspen	4,978	8,471	13,449	0.4
Other hardwoods	418	4,961	5,379	0.2
Hardwood species	63,835	453,541	517,377	17.2
Total all species	364,891	2,640,133	3,005,024	100.0

*Indicates less than 0.05 percent.

Table 8. Net annual growth of growing stock on commercial softwood and hardwood forest types by ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Ownership Group	Forest Type		
	Softwood Types	Hardwood Types	Total
-----thousand cubic feet-----			
State and Other Public	2,999	338	3,337
Other Private	20,207	2,625	22,832
All Owners	23,206	2,963	26,169

Table 9. Net annual growth of sawtimber on commercial softwood and hardwood forest types by ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Ownership Group	Forest Type		
	Softwood Types	Hardwood Types	Total
-----thousand board feet-----			
State and Other Public	9,394	1,266	10,659
Other Private	69,084	8,991	78,075
All Owners	78,478	10,257	88,734

Growth and Mortality by Ownership Group

Growth Sampled commercial timberlands in eastern Montana were growing at an annual rate of 26,169,000 net cubic feet or 88,734,000 net board feet Scribner (see Tables 8 and 9). Over time, net growth will change depending on such factors as the forest's overall age, condition, mortality rates, and the amount of harvest.

Most of the cubic foot and board foot net growth -- about 88 percent -- took place on the other private owner group's timberland. As expected, eastern Montana has the lowest average growth rates in the state. Trees on the average acre of commercial timberland grew 22.9 net cubic feet or 77.4 board feet Scribner per year. Trees on the average acre of commercial timberland in northwestern Montana, the most productive area in the state, grew 41.9 cubic feet or 131.5 board feet per year (Montana Department of State Lands, 1982).

Mortality The data shows sampled timberlands in eastern Montana lose 4,270,000 net cubic feet of growing stock or 9,130,000 net board feet of sawtimber annually due to natural mortality (see Tables 10 and 11). This timber is removed from the commercial growing stock by natural causes such as insects, disease, fire, and weather. Timber removed through logging is not considered when computing mortality figures.

The mortality rates in eastern Montana were lower than any other region in the state. The average annual mortality rate in eastern Montana was 3.1 cubic feet of growing stock per acre, or 5.9 board feet per acre for sawtimber (see Table 12).

Table 10. Net annual mortality of growing stock on commercial softwood and hardwood forest types by ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Ownership Group	Forest Type		
	Softwood Types	Hardwood Types	Total
-----thousand cubic feet-----			
State and Other Public	392	171	563
Other Private	2,750	957	3,707
All Owners	3,142	1,128	4,270

Area by Site Class

Commercial timberland was placed in one of three productivity classes (see Tables 13 and 14). As shown in Table 14, about 81 percent of the timberland had the potential to produce from 20 to 49 cubic feet of wood per acre per year. Table 13 indicates Douglas-fir and aspen forest types were potentially more productive on the average than the other forest types in the region.

An average sampled acre of commercial timberland had the potential to produce 37 cubic feet of timber per year. The potential yield per acre estimate for eastern Montana is below the per acre potential estimated for the Rocky Mountain region of 60 cubic feet per year (USDA Forest Service (1973)). It is also the lowest estimated potential yield per acre within the state of Montana when compared to other working circles. (Montana DSL 1979, 1982, 1983, 1984). Average potential productivity for each working circle in eastern Montana is shown in Table 22, page 43 of this publication.

Table 11. Net annual mortality of sawtimber on commercial softwood and hardwood forest types by ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Ownership Group	Forest Type		
	Softwood Types ----- thousand board feet-----	Hardwood Types	Total
State and Other Public	697	407	1,104
Other Private	<u>5,263</u>	<u>2,763</u>	<u>8,026</u>
All Owners	5,960	3,170	9,130

Table 12. Net annual mortality and net and gross growth per acre for commercial softwood forest types by ownership group, Working Circles 4, 5, 6, 7, and 8 (cubic feet and board feet Scribner).

	Ownership Group		
	State and Other Public	Private	Total
Mortality			
Ft ³ /acre	2.9	3.1	3.1
BFS/acre	5.1	6.0	5.9
Net Growth			
Ft ³ /acre	21.9	23.1	22.9
BFS/acre	68.6	78.8	77.4
Gross Growth			
Ft ³ /acre	24.8	26.2	26.0
BFS/acre	73.7	84.8	83.3

Table 13. Area of commercial timberland by forest type and M.A.I. site class, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Forest Type	Site Class (cubic feet/acre/year)			A11 Classes
	20-49	50-84	85-119	
-----thousand acres-----				
Ponderosa pine	708.3	90.9	6.6	805.8
Douglas-fir	85.9	74.7	3.2	163.9
Lodgepole pine	27.2	7.0	3.1	37.3
Juniper	3.5	-	-	3.5
Whitebark-limber pine	2.3	-	-	2.3
Spruce	-	0.8	-	0.8
Softwood types	<u>827.1</u>	<u>173.5</u>	<u>12.9</u>	<u>1,013.5</u>
Cottonwood	91.9	23.2	-	115.1
Aspen	16.2	13.5	-	29.7
Other hardwoods	<u>0.8</u>	<u>1.4</u>	<u>-</u>	<u>2.3</u>
Hardwood types	<u>109.0</u>	<u>38.2</u>	<u>-</u>	<u>147.1</u>
All forest types	<u>936.0</u>	<u>211.7</u>	<u>12.9</u>	<u>1,160.6</u>

Table 14. Area of commercial timberland by M.A.I. site class and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Site Class (ft ³ /acre/year)	Ownership Group					
	State and Other Public		Private		Total	
	-----thousand acres-----					
	%	%	%	%	%	%
20 - 49	127.1	81.9	809.0	80.5	936.0	80.7
50 - 84	27.2	17.5	184.5	18.3	211.7	18.2
85 - 119	<u>0.9</u>	<u>0.6</u>	<u>11.9</u>	<u>1.2</u>	<u>12.9</u>	<u>1.1</u>
Total	155.1	100.0	1,005.4	100.0	1,160.6	100.0

The Grazable Forest Land Resource

Of the commercial timberland sampled, 1,012,700 acres were found to be grazable. An estimated 79 percent of this land was classified as being in good or excellent condition. The carrying capacity on the grazable forest land was judged to be 154,800 AUM's. If every acre of grazable forest land had been in excellent condition, the potential available carrying capacity would be 211,000 AUM's. Actual available carrying capacity was 73 percent of potential.

Range condition, an estimate of the departure from climax based on the species composition of the understory vegetation, was calculated for each commercial field location. It was assumed that the forage potential of understory vegetation in stands of timber with a crown density greater than 70 percent was so low that these sites were not sampled. Also, although unproductive forest lands have the potential to produce relatively large amounts of forage, these lands contained few inventory plots and were not sampled for range condition.

The data summarized in Tables 15 through 17 was obtained from grazing guides developed by the SCS. Appendix 7 contains a sample grazing guide and an example of the field data form used.

Overall Condition

Understory vegetation was estimated to be in good or excellent condition on 795,900 acres of commercial timberland or 69 percent of the grazable timberland. Understory vegetation on another 216,900 acres was found to be in fair or poor condition. The remaining 147,900 acres had crown densities greater than 70 percent (see Table 15).

Crown density did not appear to have any relationship to the amount of overgrazing. About 20 percent of the commercial timberland in each crown density group was in fair or poor condition. This relationship was different than what was found in other parts of the state. In Working Circles 1, 2, and 3 overgrazing was more prevalent in the 0-30 crown density group (Montana DSL 1982, 1983, 1984).

There were 216,900 acres of public and private forested range land in fair or poor condition which, unless the condition of the land is currently improving, need re-evaluation of their stocking rates. Grazable timberland that was rated as good or excellent could also be experiencing overgrazing.

Forest understories that are experiencing overgrazing should be rested by reducing or eliminating grazing for a period of time. This will allow the natural balance within the plant community to be restored and ultimately increase the forage suitable for grazing. If the understory is not rested and the overgrazing continues, the range condition will keep declining until the forage is virtually worthless for grazing. Overgrazing can also impair the health of livestock, reduce water quality, and adversely affect other resources.

Table 15. Area of commercial timberland by condition class, crown density, and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Condition Class and Crown Density	State and Other Public	Ownership Group	
		Private	Total
-----thousand acres-----			
Excellent			
0 - 30	27.4	154.2	181.6
31 - 50	20.5	110.9	131.3
51 - 70	8.0	53.9	61.9
Total	55.9	319.0	374.9
Good			
0 - 30	16.3	94.3	110.6
31 - 50	15.9	123.2	139.1
51 - 70	21.8	149.4	171.3
Total	54.0	367.0	421.0
Fair			
0 - 30	11.3	68.0	79.3
31 - 50	7.6	49.9	57.5
51 - 70	5.0	49.7	54.7
Total	23.9	167.6	191.5
Poor			
0 - 30	0.5	4.5	4.9
31 - 50	1.2	9.0	10.2
51 - 70	1.3	9.0	10.3
Total	3.0	22.4	25.4
Crown Density Totals			
0 - 30	55.5	321.0	376.4
31 - 50	45.2	292.9	338.1
51 - 70	36.1	262.1	298.2
71+	18.4	129.5	147.9
Working Circle Totals	155.1	1,005.4	1,160.6

Current Carrying Capacity

The current carrying capacity, expressed as available animal unit months or AUM's, is drawn from the condition of the forest's understory vegetation, crown density, and an adjustment based on the amount of the area that will be grazed by livestock (primarily cattle). This adjustment is called a grazability factor or utilization cut.

The available AUM's shown in Table 16 are actually recommended livestock stocking rates (see the definition of animal units in the glossary). According to the Montana grazing guides, if these stocking rates are followed, understory conditions will gradually improve. Sound range management, including grazing during the correct season of the year and proper distribution of livestock over the grazable forested area, must also be applied.

The total carrying capacity or recommended stocking rate for sampled commercial timberland in eastern Montana was estimated to be 154,802 AUM's. Most of this carrying capacity occurred on timberlands with 0-30 percent crown canopies, where shading from tall brush and trees does not inhibit the growth of grazable forage.

Grazable timberlands within the other private ownership group could support 133,477 AUM's, or 86 percent of the region's total.

Table 16. Available animal unit months (AUM's) on commercial timberlands by condition class, crown density, and ownership group, Working Circles 4, 5, 6, 7, and 8.

Condition Class and Crown Density	Ownership Group		
	State and Other Public	Private (AUM's)	Total
Excellent			
0 - 30	6,659	36,984	43,643
31 - 50	3,619	20,753	24,372
51 - 70	636	4,384	5,020
Total	10,914	62,121	73,035
Good			
0 - 30	4,007	22,678	26,685
31 - 50	1,884	14,667	16,551
51 - 70	1,146	9,782	10,928
Total	7,037	47,127	54,164
Fair			
0 - 30	2,265	15,182	17,447
31 - 50	480	3,916	4,396
51 - 70	249	2,397	2,646
Total	2,994	21,495	24,489
Poor			
0 - 30	26	274	300
31 - 50	343	2,384	2,727
51 - 70	11	76	87
Total	380	2,734	3,114
Crown Density Totals*			
0 - 30	12,957	75,118	88,075
31 - 50	6,326	41,720	48,046
51 - 70	2,042	16,639	18,681
Total	21,325	133,477	154,802

*No range data was collected on forest land with greater than 70% crown density because the range is considered to have no value for livestock.

Potential Carrying Capacity

Timberlands in eastern Montana carried 154,802 AUM's, or 73 percent of their potential. As shown in Table 17, potential available AUM's are the amount that could be supported if every acre of grazable commercial timberland were in excellent condition. In 1980, a total of 211,007 AUM's could have been supported on sampled timberlands.

If every grazable forest acre were in excellent condition, the 1980 carrying capacity could have been increased by 56,205 AUM's. Translated into head of cattle, assuming a four month grazing season, the recommended stocking rate could have been increased from 38,700 to 52,800 head.

The potential number of AUM's depends on more than just the understory condition. Other factors, like the number of acres in each crown density group and the grazability factor, also affect the carrying capacity. Obviously, one way to increase AUM's would be to harvest enough timber so that every acre has a crown density of 0-30 percent. A more practical and realistic way to increase potential available AUM's is to increase the grazability through effective range management. Salting, herding, fencing, increasing the number of trails, increasing water developments, and reducing slash, debris, and other mechanical barriers are some of the management techniques that might be used. Properly applied, these methods will increase the amount of grazed forest land and thus the range's carrying capacity.

Table 17. Potential animal unit months (AUM's) on commercial timberland by crown density and ownership group, Working Circles 4, 5, 6, 7, and 8.

Crown Density	Ownership Group		
	State and Other Public	Private (AUM's)	Total
0 - 30	16,968	100,529	117,497
31 - 50	8,480	57,751	66,231
51 - 70	3,018	24,261	27,279
71+	-	-	-
Total	28,466	182,541	211,007

ANALYSIS OF THE TIMBER RESOURCE

In this section, maximizing timber production was used as a basis for analyzing the forest inventory data. The analysis reviews the biological condition of the commercial timberland, and assesses timber availability and the quality of the forest land for timber production. Some specific areas examined were: silvicultural treatment opportunities, stand age distribution, timberland quality classes, current growth and mortality, stocking, and the forest's biological potential for growing wood.

Forest Condition

An average acre of commercial timberland in the working circle was estimated to have the potential to produce 37 cubic feet of wood per acre per year. The average net growth per acre for softwood forest types was estimated to be 24 cubic feet per year. The mortality rate was moderate to low and was calculated to be equal to 14 percent of the total cubic foot gross growth at the time of measurement. Gross growth was estimated to be 26 cubic feet per acre per year.

Public and private timberlands were dominated by young growth sawtimber stands. Sixty-nine percent of the commercial timberland area contained stands ranging in age from 41 to 100 years old. It was also discovered that much of the state and private timberland was not stocked properly for optimum board foot production. One analysis estimated 29 percent of the commercial timberland acreage was improperly stocked for realizing full board foot growth potential. The data indicated understocking was the most common unfavorable stocking situation in eastern Montana.

Growth and Mortality

Gross Growth At the time of measurement, gross growth in cubic feet per year for all growing stock softwood species was about 2.7 percent of the working circle's total cubic foot volume (see Table 18). Working Circles 7 and 8 exhibited the highest rate of growth with an annual increase in total cubic foot volume of 3.1 percent.

Table 18. Net volume, gross growth, mortality, and net growth of growing stock and sawtimber by softwood and hardwood species on commercial timberland, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet, thousand board feet Scribner).

	Growing Stock		Sawtimber	
	M Net Cubic Foot Volume	% of Total Cubic Foot Volume	M Net Board Foot Volume	% of Total Board Foot Volume
Working Circle 4 Softwood Species				
Total Volume	460,902	100.0	1,125,020	100.0
Gross Growth	12,328	2.7	40,850	3.6
Mortality	1,504	0.3	3,261	0.3
Net Growth	10,824	2.3	37,588	3.3
Working Circle 5 Softwood Species				
Total Volume	52,251	100.0	132,590	100.0
Gross Growth	1,197	2.3	4,502	3.4
Mortality	323	0.6	698	0.5
Net Growth	874	1.7	3,804	2.9
Working Circle 6 Softwood Species				
Total Volume	150,103	100.0	429,487	100.0
Gross Growth	3,298	2.2	12,836	3.0
Mortality	166	0.1	471	0.1
Net Growth	3,132	2.1	12,366	2.9
Working Circles 7 and 8 Softwood Species				
Total Volume	307,309	100.0	800,549	100.0
Gross Growth	9,380	3.1	26,859	3.4
Mortality	1,182	0.4	1,601	0.2
Net Growth	8,198	2.7	25,258	3.2
All Working Circles Softwood Species				
Total Volume	970,565	100.0	2,487,646	100.0
Gross Growth	26,203	2.8	85,047	3.4
Mortality	3,175	0.3	6,030	0.2
Net Growth	23,028	2.4	79,016	3.2
All Working Circles Hardwood Species				
Total Volume	167,954	100.0	517,377	100.0
Gross Growth	4,237	2.5	12,818	2.5
Mortality	1,096	0.7	3,100	0.6
Net Growth	3,141	1.9	9,718	1.9

Mortality The data collected in 1979 and 1980 indicates mortality was occurring at a low to moderate rate. Mortality in softwoods, expressed as a percentage of the total softwood volume, was 0.3 percent for cubic foot and 0.2 percent for board foot volume. Mortality in the entire Rocky Mountain region was estimated at 0.5 percent of total volume (USDA Forest Service 1978). At the time of measurement, mortality equaled 14 percent of the cubic foot gross growth and 9 percent of the board foot gross growth taking place in the working circle.

Mortality rates for softwood species were estimated to be highest in Working Circle 5. The mortality rates in Working Circle 6 were unusually low. They were estimated to be only 0.1 of a percent of total softwood volume on a cubic foot and board foot basis (see Table 18).

The major known causes of tree death in 1979 and 1980 were categorized as weather, disease, and insects (see Table 19). Weather caused tree mortality by windthrow, snow breakage, and lightning. Disease includes various rots, rusts, and mistletoe. Insects include bark beetles and, occasionally, defoliators.

Animals also contributed significantly to mortality. Two species of animals were primarily responsible for this mortality: beavers and porcupines.

The category termed "unknown" was used by inventory crews when they could not determine which damaging agent was primarily responsible for killing the tree. (The inventory's mortality tree procedure allowed only one damaging agent to be recorded. Frequently the death of a tree was caused by two or more agents in concert or succession).

Ponderosa pine was the major victim of weather and insects. Douglas-fir and cottonwood were major victims of disease, while most of the trees killed by "unknown" factors were ponderosa pine and cottonwood.

At the time of measurement, weather, disease, and insects shared dominant roles as the major causes of death in eastern Montana. However, the causes of mortality in a forest are dynamic and cyclic, and in a future inventory the major causes of death may be different.

Table 19. Net annual mortality of growing stock on commercial timberland by species and cause of death,
Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Species	Cause of Death						Total All Causes
	Insects	Disease	Fire	Animal	Weather	Suppression	
				thousand cubic feet--			
Ponderosa Pine	707	164	82	27	648	30	478
Douglas-fir	19	333	-	52	155	-	106
Lodgepole Pine	-	-	-	22	139	-	96
Whitebark-limber pine	-	-	-	-	26	-	92
Spruce	-	-	-	-	-	-	-
Subalpine fir	-	-	-	-	-	-	-
Total softwoods	<u>726</u>	<u>496</u>	<u>82</u>	<u>101</u>	<u>968</u>	<u>30</u>	<u>771</u>
Cottonwood	-	350	-	124	19	-	412
Aspen	-	-	-	9	-	-	167
Other hardwoods	-	-	-	<u>133</u>	<u>19</u>	<u>-</u>	<u>-</u>
Total hardwoods	<u>726</u>	<u>846</u>	<u>82</u>	<u>234</u>	<u>987</u>	<u>30</u>	<u>1,350</u>
Total all species							15
							4,271

Table 20. Net volume, gross growth, mortality, and net growth of growing stock on commercial timberland by diameter class for softwood species, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Diameter Class	Volume	Gross Growth		Mortality		Net Growth	
		-----thousand cubic feet-----		%*	%*	%*	%*
5.0 - 6.9	98,369	8,249	8.4	620	0.6	7,629	7.8
7.0 - 8.9	140,675	3,845	2.7	686	0.5	3,159	2.2
9.0 - 10.9	181,506	4,413	2.4	502	0.3	3,911	2.2
11.0 - 12.9	173,111	3,847	2.2	673	0.4	3,174	1.8
13.0 - 14.9	137,373	2,557	1.9	147	0.1	2,410	1.8
15.0 - 16.9	97,115	1,652	1.7	343	0.4	1,309	1.3
17.0 - 18.9	66,523	930	1.4	66	0.1	865	1.3
19.0 - 20.9	31,776	400	1.3	76	0.2	324	1.0
21.0 - 22.9	17,904	150	0.8	55	0.3	95	0.5
23.0 - 24.9	7,662	57	0.7	7	0.1	50	0.7
25.0 - 26.9	7,929	42	0.5	-	-	42	0.5
27.0 - 28.9	3,534	23	0.7	-	-	23	0.7
29.0+	<u>7,086</u>	<u>39</u>	<u>2.7</u>	<u>-</u>	<u>-</u>	<u>39</u>	<u>0.6</u>
Total	970,565	26,203	2.7	3,175	0.3	23,028	2.4

*Percent of total volume in each diameter class.

Table 21. Net volume, gross growth, mortality, and net growth of sawtimber on commercial timberland by diameter class for softwood species, Working Circle 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Diameter Class	Volume	Gross Growth		Mortality		Net Growth	
		-----thousand board feet-----		%*	%*	%*	%*
9.0 - 10.9	377,491	35,071	9.3	988	0.3	34,083	9.0
11.0 - 12.9	540,622	19,558	3.6	2,172	0.4	17,386	3.2
13.0 - 14.9	514,183	13,470	2.6	621	0.1	12,849	2.5
15.0 - 16.9	406,986	8,650	2.1	1,368	0.3	7,282	1.8
17.0 - 18.9	294,182	4,757	1.6	263	0.1	4,494	1.5
19.0 - 20.9	145,630	2,011	1.4	337	0.2	1,674	1.1
21.0 - 22.9	83,310	733	0.9	245	0.3	488	0.6
23.0 - 24.9	36,851	283	0.8	35	0.1	248	0.7
25.0 - 26.9	36,726	202	0.6	-	-	202	0.6
27.0 - 28.9	16,738	116	0.7	-	-	116	0.7
29.0+	<u>34,928</u>	<u>195</u>	<u>0.6</u>	<u>-</u>	<u>-</u>	<u>195</u>	<u>0.6</u>
Total	2,487,647	85,047	3.4	6,030	0.2	79,016	3.2

*Percent of total volume in each diameter class.

Net Growth In 1979 and 1980, net growth of softwoods was 23,028,000 cubic feet for growing stock and 79,016,000 board feet for sawtimber. This represented 2.7 percent of the softwood cubic foot volumes and 3.2 percent of the softwood board foot volume (see Tables 20 and 21). For the Rocky Mountain region, net growth for softwoods was 1.7 percent (USDA Forest Service 1978).

Over time, net growth will increase or decrease in response to changes in mortality rates, harvest rates, amounts of insects or disease, and the forest's stocking and age distribution. All of these factors can be manipulated to some degree through the management practices applied to the forest.

Potential Growth

Potential growth or yield is net growth expressed in cubic feet per acre per year as calculated by the forest inventory computation process. The estimate is based on yield tables developed for fully stocked, even-aged stands of single species. These yield tables are used to construct mean annual increment curves. Site indices derived from site trees measured on the field location are used to choose the proper mean annual increment curve. The potential cubic foot yield per acre per year is determined based on the culmination point of the mean annual increment curve. The age at the culmination point is the biological harvest age for producing the maximum amount of wood. This estimate of biological potential is considered to be less than the potential for intensively managed stands. In eastern Montana the potential yield was often adjusted downward based on stockability. These stockability factors were derived from the habitat type of the field plot.

The average potential net growth for all forest types in eastern Montana was estimated to be 37 cubic feet per acre per year (see Table 22). Average gross growth per acre for all forest types was estimated to be 26 cubic feet per year, or about 65 percent of potential net growth. The average net growth per acre for all forest types was estimated to be 24 cubic feet per year, or about 59 percent of potential net growth. Nationally, net growth was 38 cubic feet per acre per year or about 51 percent of potential net growth (74 cubic feet) in 1970. Net growth for the Rocky Mountain region was estimated to be 24 cubic feet per acre per year, or about 40 percent of the 60 cubic foot potential net growth (USDA Forest Service 1973).

When a forest is composed of stands in many age classes, a gap between net growth and potential net growth should be expected. However, a large gap between net growth and potential net growth may indicate management opportunities exist to increase production. Studying the forest's growth-related physical characteristics should suggest ways to reduce this gap.

Table 22. Average potential productivity per acre by working circle for commercial timberland, Working Circles 4, 5, 6, 7, and 8.

Working Circle	Average Potential Productivity (cubic feet/acre)	Net Growth (cubic feet/acre)
4	40	26
5	39	17
6	39	25
7	36	20
8	33	20
Eastern Montana Total	37	23

Existing Stand Structure

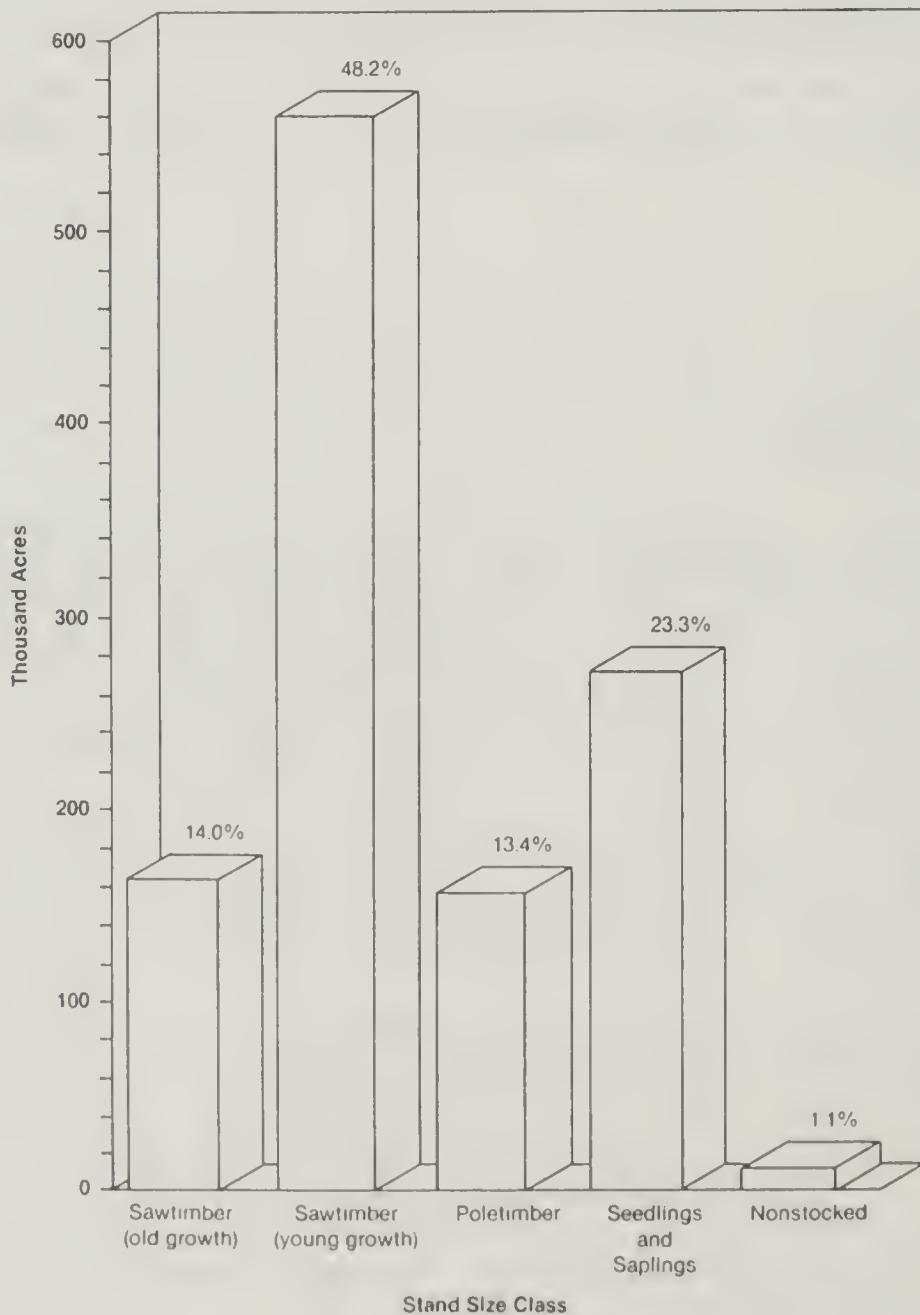
Distribution by Stand Size Class Young growth sawtimber stands dominated the forest composition of eastern Montana according to distribution by stand size class data. These stands occurred on 48 percent of the commercial timberland acreage at the time of sampling. Only 12,700 acres, or 1.1 percent of all timberlands in eastern Montana, were found to be nonstocked (see Figure 6).

The large acreage of seedling and sapling stands in eastern Montana is not the result of timber harvesting. It is due primarily to encroachment of the forest into nonforest zones because of fire suppression.

Distribution by Stand Age Class Distribution by stand age class data showed much of the timberland acreage to be occupied by medium-aged stands. About 69 percent of the total softwood acreage -- 697,900 acres -- was covered by stands between 41 and 100 years old (see Table 23).

Working Circles 7 and 8 had the largest percentage of their land occupied by young- to medium-aged stands. Seventy-two percent of the timberland acreage had stand ages of 41 to 100 years old.

Figure 6. Area of commercial timberland by stand size class, Working Circles 4, 5, 6, 7, and 8 (acres).



Distribution by Stocking Percent Stocking is a qualitative term used to describe the "degree of adequacy" of a stand in a particular condition to meet a certain timber management objective (Gingrich 1964). (Table 24 shows an assessment of the forest's stocking for producing board-foot volume by displaying the amount of area in each stocking percent class.) Stocking percent is the amount of space available to one live tree on a given acre compared to the amount of space necessary for optimum yield, measured as a percentage. The amount of space needed for optimum yield depends on tree size and site quality. Consequently, the desired amount of space will vary from one sampled acre to the next (Farrenkopf 1967).

There are three stocking percent classes: less than 60 percent stocked (understocked), 60 to 132 percent stocked, and greater than 132 percent stocked (overstocked). Each field plot can be up to 167 percent stocked, since each individual sample point of the ten point cluster can be up to 16.7 percent stocked (10 points X 16.7 percent stocking per point = 167 percent stocking per field plot), depending on the size and number of trees present. Some of the individual sample points tally more trees than required to be 16.7 percent stocked. In those instances the stocking percent remains 16.7 and will go no higher. A stocking percent class rating of 100 percent is equivalent to 60 percent of the basal area listed by a normal yield table. A normal

Table 23. Area of commercial softwood timberland by stand age class and working circle, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Stand Age Class	Working Circle									
	4		5		6		7 & 8		Total	
-----thousand acres-----										
Unclassified	-	-	7.2	10.9	4.0	3.3	0.6	0.2	11.8	1.2
1 - 20	58.2	13.6	-	-	3.7	3.0	28.5	7.2	90.4	8.9
21 - 40	34.8	8.1	2.3	3.5	1.2	1.0	10.7	2.7	49.0	4.8
41 - 60	30.4	7.1	8.6	13.1	23.3	18.8	41.8	10.6	104.1	10.3
61 - 80	145.5	33.9	10.9	16.6	38.4	31.0	158.8	40.2	353.6	34.9
81 - 100	96.3	22.4	19.3	29.3	40.1	32.4	84.5	21.4	240.2	23.7
101 - 120	50.1	11.7	11.4	17.3	8.8	7.1	30.8	7.8	101.2	10.0
121 - 140	6.9	1.6	3.8	5.8	1.2	1.0	12.8	3.3	24.6	2.4
141 - 160	-	-	2.3	3.5	-	-	24.1	6.1	26.4	2.6
161 - 180	7.0	1.6	-	-	3.0	2.4	2.1	0.5	12.2	1.2
181 - 200	-	-	-	-	-	-	-	-	-	-
201+	-	-	-	-	-	-	-	-	-	-
Total	429.0	100.0	65.9	100.0	123.8	100.0	394.7	100.0	1,013.5	100.0

yield table shows the maximum volume, number of trees, and basal area that a given site can support at a given age (Davis 1966). A stocking percent class rating of 132 percent is equivalent to 80 percent of the basal area listed by a normal yield table. Volume predictions made by normal yield tables are for fully stocked stands grown under "natural" conditions without competition and do not predict the yield that could be captured from a given site if managed. It is believed that a range of stocking between 60 and 100 percent of the normal yield table basal area is the range within which the full board-foot growth potential of a forest acre can be realized. Theoretically, trees in this stocking range are beginning to fully use the site and growth per acre is not reduced by overcrowding.

Table 24 shows that, at the time of sampling, about 29 percent of the commercial timberland in eastern Montana was improperly stocked for realizing its full board-foot growth potential. Approximately 282,700 acres were understocked and only 49,600 acres were overstocked. Working Circle 4 had the most favorable stocking situation in the region. Only 18 percent of the commercial timberland area was improperly stocked.

The area by stocking percent data shows understocking to be the most common unfavorable stocking situation in eastern Montana.

Table 24. Area of commercial timberland by working circle, stand size class, and stocking percent class, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

	Stocking Percent Class							
	59 or less (understocked)		60-132		133 or more (overstocked)		Total	
	-----thousand acres-----							
Working Circle 4		%		%		%		%
Old growth sawtimber	3.9	0.9	49.4	11.1	-	-	53.3	11.9
Young growth sawtimber	35.0	7.8	165.4	37.1	9.7	2.2	210.1	47.1
Poletimber	3.1	0.7	46.7	10.5	6.7	1.5	56.5	12.7
Seedlings and saplings	18.0	4.0	104.1	23.3	3.9	0.9	126.0	28.3
Nonstocked	-	-	-	-	-	-	-	-
Total	60.1	13.4	365.7	82.0	20.3	4.6	446.0	100.0
Working Circle 5								
Old growth sawtimber	8.3	9.8	8.1	9.5	-	-	16.4	19.3
Young growth sawtimber	15.4	18.1	22.2	26.2	1.2	1.4	38.7	45.6
Poletimber	4.1	4.8	5.9	7.0	1.3	1.5	11.3	13.3
Seedlings and saplings	-	-	9.1	10.7	1.3	1.5	10.4	12.3
Nonstocked	6.9	8.1	1.2	1.4	-	-	8.1	9.5
Total	34.7	40.8	46.4	54.8	3.7	4.4	84.8	100.0
Working Circle 6								
Old growth sawtimber	5.8	4.1	8.7	6.2	-	-	14.5	10.4
Young growth sawtimber	18.0	12.9	52.6	37.6	3.0	2.1	73.6	52.6
Poletimber	4.2	3.0	13.1	9.4	6.8	4.9	24.0	17.2
Seedlings and saplings	7.3	5.2	16.4	11.7	-	-	23.7	16.9
Nonstocked	4.0	2.9	-	-	-	-	4.0	2.9
Total	39.2	28.1	90.8	64.9	9.8	7.0	139.8	100.0
Working Circles 7 & 8								
Old growth sawtimber	26.7	5.5	48.1	9.8	3.0	0.6	77.8	15.9
Young growth sawtimber	88.9	18.1	147.5	30.1	0.8	0.2	237.2	48.4
Poletimber	20.5	4.2	37.9	7.7	4.9	1.0	63.3	12.9
Seedlings and saplings	12.0	2.5	91.8	18.7	7.1	1.5	111.0	22.7
Nonstocked	0.6	0.1	-	-	-	-	0.6	0.1
Totals	148.8	30.4	325.4	66.3	15.8	3.3	490.0	100.0
Eastern Montana Total								
Old growth sawtimber	44.8	3.9	114.3	9.8	3.0	0.3	162.1	14.0
Young growth sawtimber	157.2	13.5	387.8	33.4	14.7	1.3	559.7	48.2
Poletimber	31.9	2.7	103.6	8.9	19.7	1.7	155.2	13.4
Seedlings and saplings	37.3	3.2	221.4	19.1	12.3	1.1	271.0	23.3
Nonstocked	11.5	1.0	1.2	0.1	-	-	12.7	1.1
Totals	282.7	24.3	828.2	71.3	49.6	4.4	1,106.6	100.0

Timberland Quality Class

Approximately 838,400 acres, or 83 percent, of the commercial softwood timberland in eastern Montana was rated as fair for timber production based on a classification system developed for Montana. Only 15 percent, or 147,000 acres, of the timberland was rated as excellent or good for timber production. Working Circle 4 contained 64 percent (94,700 acres) of the regions excellent or good rated timberlands. Working Circles 7 and 8 had 92 percent of their commercial timberland area rated as fair.

Timberland quality classes in this analysis are used to rate commercial timberlands according to their relative value for producing timber. The rankings are based primarily on factors that indicate the operability and productivity of the forest. Four quality classes -- excellent, good, fair, and poor -- were used. To avoid confusing the findings of this timberland rating effort with those of other state and federal land management agencies, the term "prime timberlands" was not used.

Class Definitions

The criteria used to place timberlands into the appropriate quality classes are as follows:

Excellent timberlands

- have a potential productivity that is greater than or equal to 85 cubic feet per acre per year;
- have a slope that is less than or equal to 40 percent;
- are less than or equal to 8,000 feet in elevation.

Good timberlands

- do not meet the requirements for excellent timberlands;
- have a potential productivity that is greater than or equal to 50 cubic feet per acre per year;
- have a slope that is less than or equal to 40 percent if potential productivity is less than 85 cubic feet per acre per year;
- are less than or equal to 8,000 feet in elevation.

Fair timberlands

- do not meet the requirements for good or excellent timberlands;
- have a potential productivity that is greater than or equal to 20 cubic feet per acre per year;
- have a slope that is less than or equal to 56 percent;
- are less than or equal to 8,000 feet in elevation.

Poor timberlands

- do not meet the requirements for excellent, good, or fair timberlands.

Timberland Quality Class and Stand Size Class

About 15 percent, or 147,000 acres, of the commercial softwood timberland in the eastern Montana was rated as good or excellent for timber production. Twenty-four percent of the young-growth sawtimber stands were found on good- or excellent-rated timberlands. An estimated 838,400 acres, or 83 percent of the commercial softwood timberland, was rated as fair for timber production (see Figure 7). Thirty-one percent of the timberland rated as fair was occupied by seedling, sapling, and nonstocked stands; another 56 percent was occupied by sawtimber stands.

Timberland Quality Class by Working Circle

Sixty-four percent of the 147,000 acres of excellent and good timberland in eastern Montana was located in Working Circle 4. All of the excellent timberlands were located in Working Circle 4.

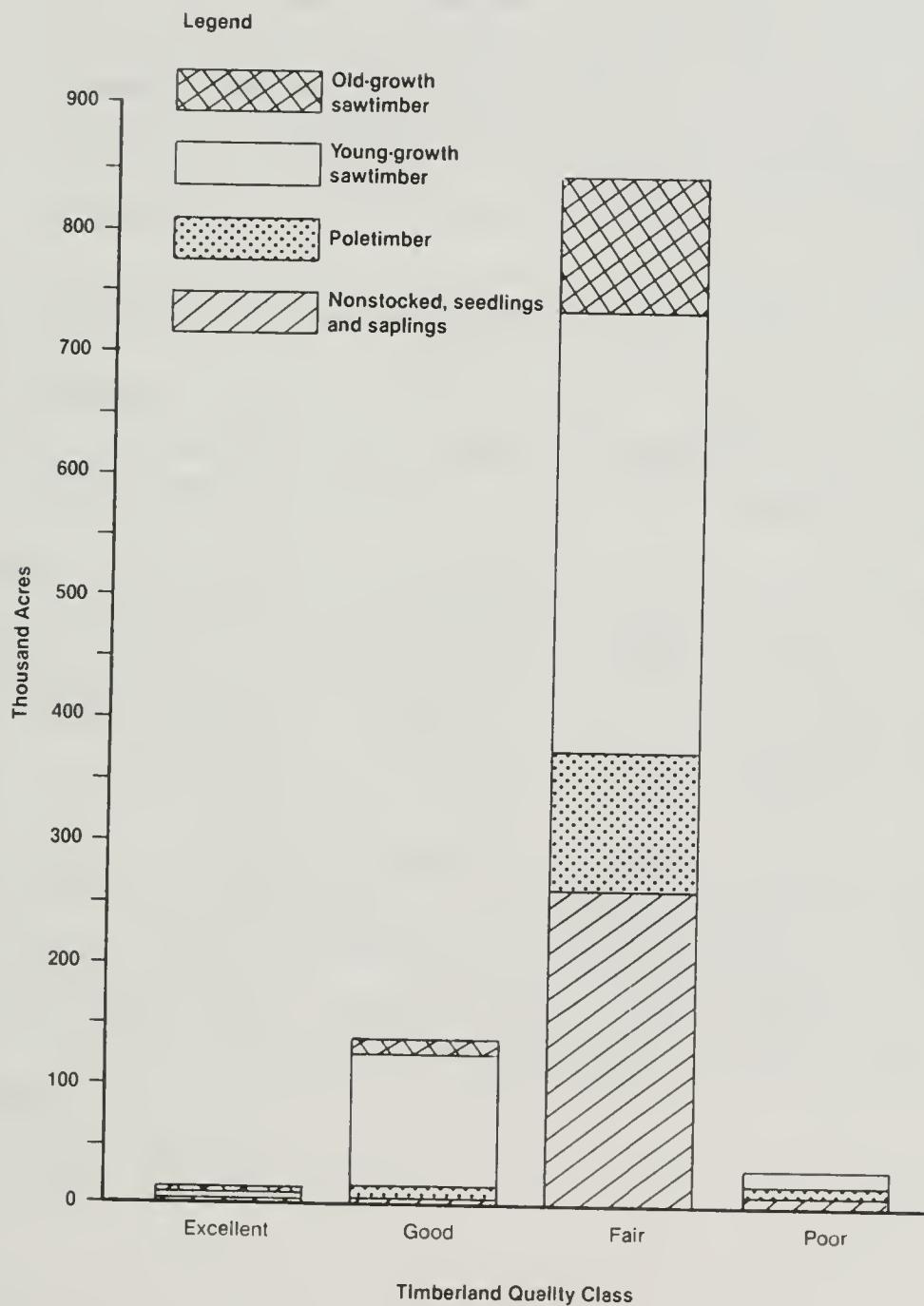
Working Circles 7 and 8 were dominated by timberland rated as fair. About 92 percent of the commercial timberland (361,500 acres) was so rated.

On a percentage basis Working Circle 6 had as much good-rated timberland (21 percent) as Working Circle 4 (19 percent).

Table 25. Area of commercial softwood timberland by stand size class, timberland quality class and working circle, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
Working Circle 4	-----thousand acres-----				
Old growth sawtimber	3.2	6.6	43.6	-	53.3
Young growth sawtimber	6.6	65.1	134.7	-	206.4
Poletimber	-	6.2	37.0	-	43.2
Seedlings and saplings	3.1	3.9	119.0	-	126.0
Nonstocked	-	-	-	-	-
Total	12.9	81.8	334.4	-	429.0
Working Circle 5					
Old growth sawtimber	-	-	16.4	-	16.4
Young growth sawtimber	-	6.2	19.3	4.6	30.1
Poletimber	-	1.3	3.7	1.1	6.2
Seedlings and saplings	-	-	4.7	1.3	6.0
Nonstocked	-	-	6.1	1.2	7.2
Total	-	7.5	50.2	8.2	65.9
Working Circle 6					
Old growth sawtimber	-	3.0	10.0	-	13.1
Young growth sawtimber	-	22.4	39.4	6.1	67.9
Poletimber	-	-	21.2	-	21.2
Seedlings and saplings	-	-	17.7	-	17.7
Nonstocked	-	-	4.0	-	4.0
Total	-	25.4	92.3	6.1	123.8
Working Circles 7 & 8					
Old growth sawtimber	-	2.8	38.1	0.8	41.7
Young growth sawtimber	-	16.6	166.4	-	183.0
Poletimber	-	-	50.3	8.1	58.4
Seedlings and saplings	-	-	105.9	5.0	111.0
Nonstocked	-	-	0.6	-	0.6
Total	-	19.4	361.5	13.9	394.7
Eastern Montana Totals					
Old growth sawtimber	3.2	12.4	108.1	0.8	124.5
Young growth sawtimber	6.6	110.3	359.9	10.6	487.4
Poletimber	-	7.5	112.3	9.2	129.0
Seedlings and saplings	3.1	3.9	247.4	6.3	260.8
Nonstocked	-	-	10.7	1.2	11.8
Total	12.9	134.1	838.4	28.1	1,013.5

Figure 7. Area of commercial softwood timberland by stand size class and timberland quality class, Working Circles 4, 5, 6, 7, and 8 (thousand acres).



Silvicultural Treatment Opportunities

The DSL, Forestry Division, developed a procedure to analyze data recorded on the field location that would place the sampled stand into one of several categories. Each of these categories represented a set of silvicultural treatment opportunities. As a result of this analysis it was determined that 60 percent of the commercial timberland offered silvicultural treatment opportunities to improve the forest's condition and ultimately increase timber yields. An estimated 536,800 acres, or 53 percent of the commercial softwood timberland, were placed into categories that imply silvicultural treatment opportunities other than harvest are available. When silvicultural treatment opportunity by timberland quality class was investigated it was discovered that the leading individual treatment opportunities existing on excellent and good timberlands were: regeneration of understocked areas (43,900 acres), harvest-low risk (18,000 acres), and no treatment due to productive condition (18,000 acres).

The Forestry Division has developed a procedure for using forest inventory data to assess silvicultural treatment opportunities. As a part of this procedure, 12 treatment opportunity categories were selected, each representing a group of stands with similar characteristics. Each category was given a treatment code number and a treatment name, such as "20 - Pre-commercial thinning."

Despite its appearance, a treatment name does not prescribe a treatment -- it is merely a label for a group of stands that exhibit common characteristics. These characteristics differentiate one group of stands from another. Although these labels have a silvicultural basis, the limited amount of stand data used to derive these categories restricts the use of the process to planning.

To some degree, the treatment names used here reflect the forest management policies of the Forestry Division since different stand conditions and forestry goals demand different management techniques. Other forest managers might apply different names to these categories, or possibly combine two or more of them under a single heading, depending on their management objectives.

Multiple Treatment Opportunities

Table 102 in Appendix 5 lists the treatment opportunities that were used to describe the condition of each field location. The list is divided into three groups. The first consists of the individual treatments, the other two list possible combined treatments, which are of two types: those that do not overlap and those that may. The combined codes listed under the "possible overlap" group represent treatments that may overlap each other during actual treatment. For example, one combination of treatments suggests that a certain stand needs a treatment, or treatments, that will remove the over-story, precommercially thin, and sanitize the stand. Two or more of these needs might be met in one step. Sanitation may be partially met by precommercial thinning, or it may be partially or completely met by removing the overstory.

Understanding that some treatments may be handled simultaneously is important when allocating funds, equipment, and manpower for timber stand improvement projects. Estimates of costs and work loads may be reduced for acreages on which treatments may overlap.

The tables appearing in this section of the report summarize the treatment opportunity data by breaking up the multiple treatment categories into their basic components. For example, if 10,000 acres are assigned the multiple treatment category of overstory removal and precommercial thinning, then 10,000 acres are listed in the table for overstory removal and 10,000 acres are listed in the table for precommercial thinning. By summing the acreages assigned to the individual treatments it is possible to determine the amount of timberland offering opportunities for each type of treatment. Tables created by this process show the total number of acres assigned to each treatment opportunity class. They do not show the correct amount of commercial timberland for a given working circle because some acres are represented by two or more treatments.

For further information about the kinds of stands represented by each treatment code, see Appendix 5.

Silvicultural Treatment Opportunities by Timberland Quality Class

Forest managers usually consider a stand's potential economic return before applying silvicultural treatments. Potential productivity and operability of the land are important factors in determining the possible economic return realized from forest management activities. Therefore, a table that estimates acreage by timberland quality class and treatment opportunity class can be helpful by showing how many acres are likely to be economical to treat. Obviously, timber management funds are more likely to be spent on timberlands rated as good or excellent than on timberlands of lesser quality. The amounts of land in the different timberland quality classes that were assigned to the different treatment opportunities are shown in Tables 26 through 29. These acreages are shown for eastern Montana as a whole, as well as for the different working circles.

In eastern Montana, the treatment opportunity with the largest amount of good or excellent quality timberland at the time of measurement was regeneration of understocked areas. This treatment opportunity existed on 43,900 acres of these more productive lands. There were two categories with the second highest amount of acreage: harvest - low risk with 18,000 acres, and no treatment due to productive condition also with 18,000 acres.

Six categories indicate no immediate treatments are needed: no treatment due to productive condition, no treatment - deferred until merchantable, no treatment - inoperable, unknown - poor crowns, good growth, and the two harvest - low risk categories. In eastern Montana, approximately 407,600 acres, or about 40 percent of the commercial softwood timberlands, were placed into these treatment categories (see Table 26). An additional 69,100 acres were placed into the harvest - high risk categories. The remaining 536,800 acres, or 53 percent of the commercial softwood timberlands, were placed into categories that imply silvicultural treatment opportunities are available. If stands in the harvest - high risk categories are added, the total amount of commercial softwood timberland that could use some type of silvicultural treatment becomes 605,900 acres, or 60 percent of all softwood timberlands inventoried.

This does not mean that all of these acres should be treated. Because of the costs involved and possible nontimber resource considerations, it may not be advisable to apply the indicated treatments to some stands. Nevertheless, this total acreage figure is important because it helps to illustrate the overall condition of the forest. It also partially explains why current net growth in the working circle averages 14 cubic feet per acre per year less than potential net growth. These opportunities can be viewed with optimism if forest managers plan to take advantage of them to increase the health and vigor (productivity) of the forest.

Table 26. Area of commercial softwood timberland by treatment class and timberland quality class, Working Circles 4, 6, 7, and 8 (thousand acres).*

Treatment Class	Timberland Quality Class					Total
	Excellent	Good	Fair	Poor		
	-----thousand acres-----					
Harvest - high risk	3.2	7.0	51.7	-		61.9
Harvest - low risk	-	18.0	51.5	0.8		70.3
Commercial thinning	-	7.3	68.4	-		75.7
Overstory removal	-	14.3	122.9	3.0		140.2
Two storied stand:	-	-	7.2	-		7.2
Overstory, harvest - high risk						
Understory, manageable						
Two storied stand:	6.3	6.7	166.2	-		179.3
Overstory, harvest - low risk						
Understory, manageable						
Precommercial thinning	-	-	125.1	5.0		130.1
Stand conversion	-	6.7	36.6	-		43.3
Sanitation	3.4	-	42.0	-		45.4
Regeneration of understocked areas	-	43.9	172.3	3.0		219.2
No treatment due to productive condition	-	18.0	85.3	-		103.3
No treatment - inoperable	-	-	-	3.0		3.0
No treatment - deferred until merchantable	-	6.5	22.2	0.8		29.5
Unknown - poor crowns, good growth	-	6.2	8.7	7.3		22.2

*Silvicultural treatment opportunity data was not collected for Working Circle 5.

Silvicultural Treatment Opportunities by Working Circle

Working Circle 4 The most common treatment category in Working Circle 4 was two-storied stands with a harvest - low risk overstory and a manageable understory (179,300 acres). The second most common treatment category was regeneration of understocked areas (59,900 acres).

The total acreage represented by the six treatment categories that indicate no immediate treatments are needed was 246,500 acres (see Table 27). The remaining 182,500 acres, or 43 percent of the commercial softwood timberlands, were placed into categories that imply silvicultural treatment opportunities are available.

Table 27. Area of commercial softwood timberland by treatment class and timberland quality class, Working Circle 4 (thousand acres).

Treatment Class	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
-----thousand acres-----					
Harvest - high risk	3.2	-	35.5	-	38.7
Harvest - low risk	-	6.3	31.7	-	38.0
Commercial thinning	-	7.3	6.7	-	14.0
Overstory removal	-	9.8	45.2	-	55.0
Two storied stand:	-	-	7.2	-	7.2
Overstory, harvest - high risk					
Understory, manageable					
Two storied stand:	6.3	6.7	166.2	-	179.3
Overstory, harvest - low risk					
Understory, manageable					
Precommercial thinning	-	-	9.9	-	9.9
Stand conversion	-	6.7	31.5	-	38.2
Sanitation	3.4	-	42.0	-	45.4
Regeneration of understocked areas	-	38.9	21.0	-	59.9
No treatment due to productive condition	-	-	-	-	-
No treatment - inoperable	-	-	-	-	-
No treatment - deferred until merchantable	-	6.5	10.0	-	16.4
Unknown - poor crowns, good growth	-	6.2	6.6	-	12.8

Working Circle 6 The most common treatment category in Working Circle 6 was regeneration of understocked areas (37,600 acres). The second most common treatment category was no treatment due to productive condition (33,800 acres).

The total acreage represented by the six treatment categories that indicate no immediate treatments are needed was 48,400 acres (see Table 28). The remaining 75,400 acres, or 61 percent of the commercial softwood timberlands, were placed into categories that imply silvicultural treatment opportunities are available.

Table 28. Area of commercial softwood timberland by treatment class and timberland quality class, Working Circle 6 (thousand acres).

Treatment Class	Timberland Quality Class				
	Excellent	Good	Fair	Poor	Total
-----thousand acres-----					
Harvest - high risk	-	3.0	15.3	-	18.4
Harvest - low risk	-	8.8	2.8	-	11.6
Commercial thinning	-	-	-	-	-
Overstory removal	-	4.5	16.5	3.0	24.0
Two storied stand:	-	-	-	-	-
Overstory, harvest - high risk					
Understory, manageable					
Two storied stand:	-	-	-	-	-
Overstory, harvest - low risk					
Understory, manageable					
Precommercial thinning	-	-	20.3	-	20.3
Stand conversion	-	-	-	-	-
Sanitation	-	-	-	-	-
Regeneration of understocked areas	-	1.4	33.2	3.0	37.6
No treatment due to productive condition	-	9.1	24.7	-	33.8
No treatment - inoperable	-	-	-	3.0	3.0
No treatment - deferred until merchantable	-	-	-	-	-
Unknown - poor crowns, good growth	-	-	-	-	-

Working Circles 7 and 8 The most common treatment category in Working Circles 7 and 8 was regeneration of understocked areas (121,800 acres). The second most common treatment category was precommercial thinning (99,900 acres).

The total acreage represented by the six treatment categories that indicate no immediate treatments are needed was 108,600 acres (see Table 29). The remaining 286,100 acres, or 72 percent of the commercial softwood timberlands, were placed into categories that imply silvicultural treatment opportunities are available.

Table 29. Area of commercial softwood timberland by treatment class and timberland class, Working Circles 7 and 8 (thousand acres).

Treatment Class	Timberland Quality Class					Total
	Excellent	Good	Fair	Poor		
	-----thousand acres-----					
Harvest - high risk	-	4.0	0.8	-		4.8
Harvest - low risk	-	2.8	17.0	0.8		20.6
Commercial thinning	-	-	61.7	-		61.7
Overstory removal	-	-	61.1	-		61.1
Two storied stand:	-	-	7.2	-		7.2
Overstory, harvest - high risk						
Understory, manageable						
Two storied stand:	-	-	-	-		-
Overstory, harvest - low risk						
Understory, manageable						
Precommercial thinning	-	-	94.9	5.0		99.9
Stand conversion	-	-	5.1	-		5.1
Sanitation	-	-	-	-		-
Regeneration of understocked areas	-	3.7	118.1	-		121.8
No treatment due to productive condition	-	8.9	60.6	-		65.5
No treatment - inoperable	-	-	-	-		-
No treatment - deferred until merchantable	-	-	12.2	0.8		13.1
Unknown - poor crowns, good growth	-	-	2.1	7.3		9.4

INVENTORY DATA BY WORKING CIRCLE

Area by Owner

Both the largest working circle in the state -- Working Circle 7 -- and the smallest working circle -- Working Circle 5 -- are in eastern Montana. The mix of federal and state government ownership was quite variable between working circles. However, all working circles in eastern Montana were dominated by private land. The percentage of privately owned land ranged from 64 percent of the total land area in Working Circle 7 to 75 percent in Working Circle 4.

The largest and smallest working circles in Montana were in the area covered by this report. Working Circle 5 was the smallest, but it had by far the highest percentage of Forest Service land in eastern Montana (see Table 30). There was no Forest Service land in Working Circle 7, the state's largest. BLM land was not sampled in Working Circles 5 and 6, some of it was sampled in Working Circles 4 and 7, and all of it was sampled in Working Circle 8. Working Circle 7 had more than two-thirds of the county and municipal land, partly due to Beaver Creek Park near Havre, which is the largest county park in the nation. Working Circle 7 had the most, and the highest percentage of, publicly owned land in eastern Montana. Working Circle 5, being smallest, had the least, but Working Circle 4 had the smallest percentage of public land with 25 percent. All of the working circles in eastern Montana were dominated by privately owned land. The percentage of privately owned land ranged from 64 percent of the total land area in Working Circle 7 to 75 percent in Working Circle 4. The most private land in eastern Montana was in Working Circle 8.

Table 30. Total land area by owner and working circle, Working Circles 4, 5, 6, 7, and 8 (acres).

Owner	Working Circle 4	Working Circle 5	Working Circle 6	Working Circle 7	Working Circle 8	Eastern Montana Totals
<u>Public:</u>						
-----acres-----						
percentage of total						
USDA Forest Service	482,189 6.1	510,195 20.7	580,253 5.8	- -	811,960 3.9	2,384,597 3.8
USDI Bureau of Land Management (sampled)	304,927 3.9	- -	- -	2,812,233 13.2	2,153,870 10.3	5,271,030 8.4
USDI Bureau of Land Management (nonsampled)	522,607 6.6	208,456 8.4	186,662 1.9	573,428 2.7	- -	1,491,153 2.4
USDI Bureau of Indian Affairs	- -	- -	929,490 9.4	1,675,323 7.9	1,997,612 9.6	4,602,425 7.4
USDI National Park Service	- -	31,469 1.3	370,495 3.7	52 *	58,276 0.3	460,292 0.7
Miscellaneous Federal	121,427 1.5	160 *	73,096 0.7	977,340 4.6	70,113 0.3	1,242,136 2.0
Montana Department of State Lands	516,168 6.5	90,253 3.7	608,048 6.1	1,446,688 6.8	1,113,665 5.3	3,774,822 6.1
Other State	18,296 0.2	5,783 *	39,849 0.4	32,961 0.2	39,032 0.2	135,921 0.2
County and Municipal	2,898 *	840 *	5,867 0.1	67,473 0.3	21,894 0.1	98,972 0.2
Subtotal	1,968,512 25.0	847,156 34.3	2,793,760 28.1	7,585,498 35.6	6,266,422 30.1	19,461,348 31.2
<u>Private:</u>						
	5,919,175 75.0	1,623,436 65.7	7,137,988 71.9	3,733,652 64.4	1,551,382 69.9	4,965,633 68.8
Total	7,887,687 100.0	2,470,592 100.0	9,931,748 100.0	21,319,150 100.0	20,817,804 100.0	62,426,981 100.0

*Indicates less than 0.05%.

Timber Resource

Working Circle 8 had the most sampled forest land acreage (762,700 acres) among the working circles in eastern Montana. Working Circle 4 had the most commercial timberland acreage with 446,000 acres. The other private ownership group owned the majority of the sampled commercial timberland and the timber volume in every working circle. On a board foot Scribner basis, the other private timber volumes ranged from 169 million in Working Circle 5 to 1,048 million in Working Circle 8.

Forest Acreage by Working Circle

The proportion of sampled commercial timberland by ownership group in each working circle is shown in Figure 8. The area of each pie graph in the figure is proportional to the area of commercial timberland in the working circle. As can be seen in the figure, Working Circles 4 and 8 have the largest amount of sampled commercial timberland.

Working Circle 8 had the most sampled forest land acreage (762,700 acres) among the working circles in eastern Montana (see Table 31). Working Circle 5 had the least sampled forest land acreage with 111,800 acres. Working Circle 7 was the only working circle to have less commercial timberland acres (89,900) than it had other forest land acres (102,200).

Figure 8. Proportion of sampled commercial timberland by ownership group. The sizes of the pie graphs indicate the relative amount of sampled commercial timberland in each working circle.

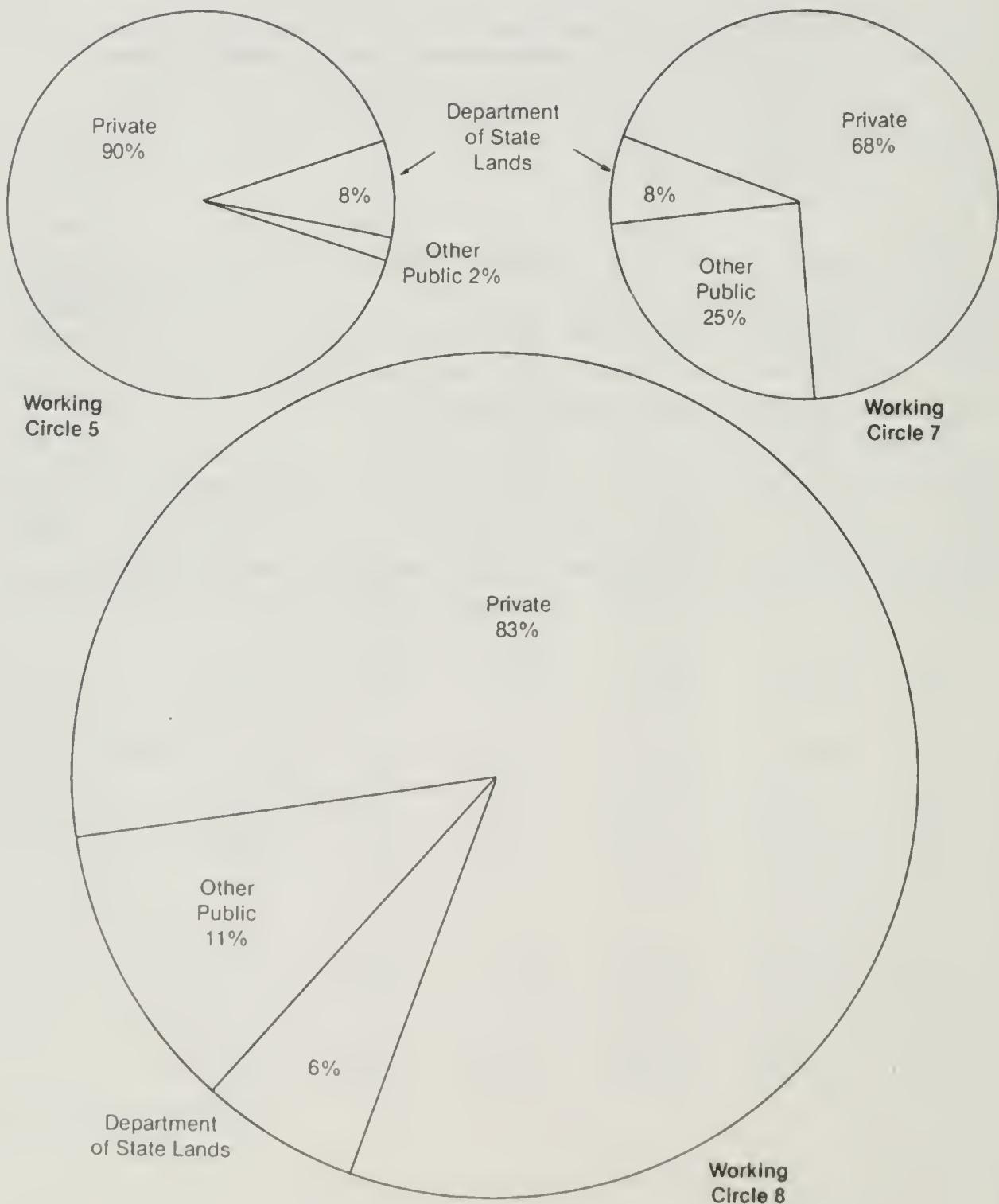


Figure 8.
(page 2)

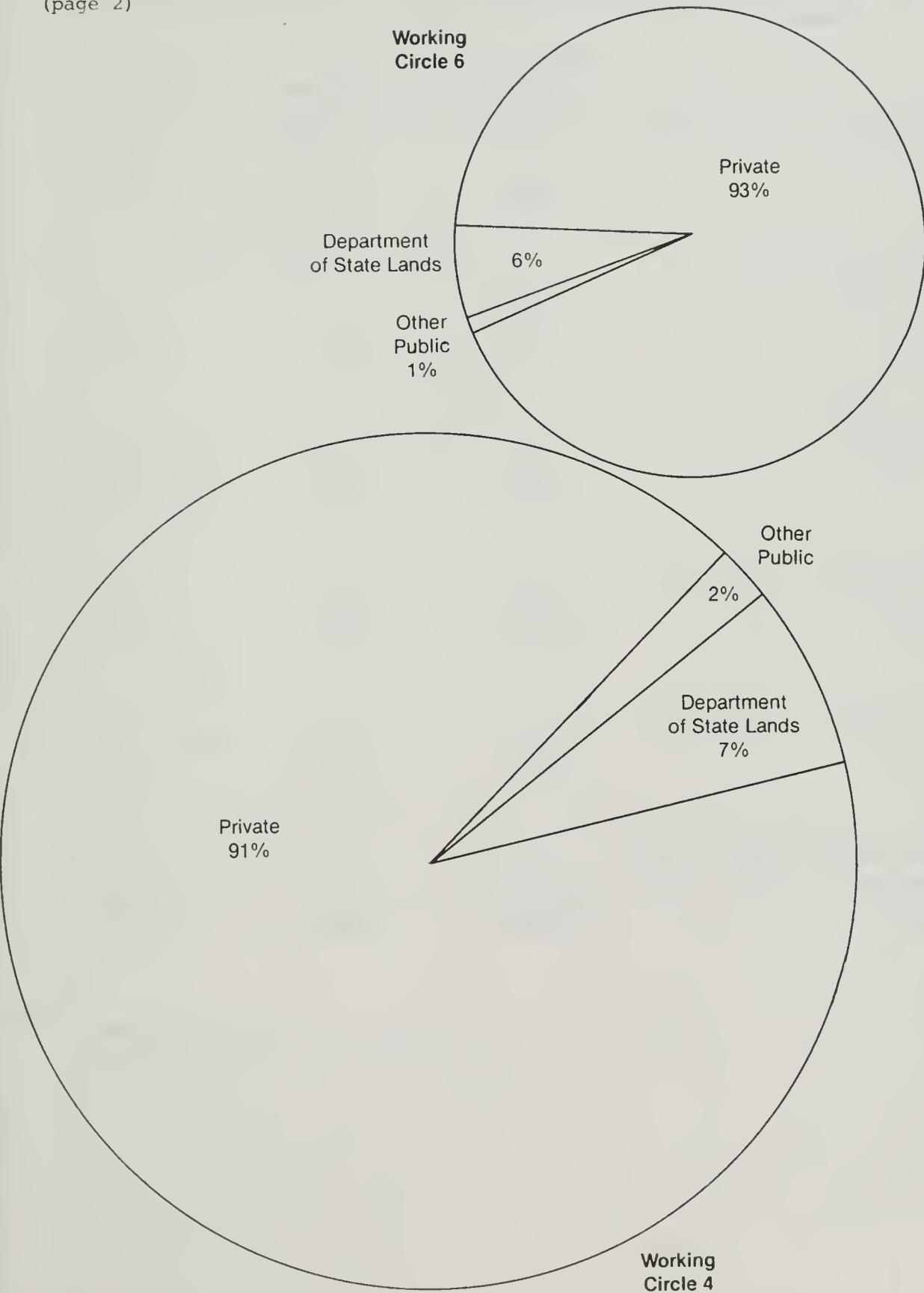


Table 31. Area of commercial and other timberland by working circle and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Ownership Group	Commercial Timberland	Other Timberland	Total Timberland
Working Circle 4			
Department of State Lands	32.2	11.6	43.8
Other public	7.7	2.9	10.6
Private	<u>406.1</u>	<u>142.9</u>	<u>548.9</u>
Total	<u>446.0</u>	<u>157.3</u>	<u>603.3</u>
Working Circle 5			
Department of State Lands	7.2	1.8	9.0
Other public	1.3	*	1.3
Private	<u>76.3</u>	<u>25.2</u>	<u>101.4</u>
Total	<u>84.8</u>	<u>27.0</u>	<u>111.8</u>
Working Circle 6			
Department of State Lands	9.2	3.7	12.9
Other public	0.8	0.5	1.3
Private	<u>129.8</u>	<u>55.5</u>	<u>185.3</u>
Total	<u>139.8</u>	<u>59.6</u>	<u>199.4</u>
Working Circle 7			
Department of State Lands	6.9	9.7	16.6
Other public	22.1	34.3	56.5
Private	<u>60.9</u>	<u>58.1</u>	<u>119.0</u>
Total	<u>89.9</u>	<u>102.2</u>	<u>192.1</u>
Working Circle 8			
Department of State Lands	23.9	23.1	47.0
Other public	43.7	46.6	90.3
Private	<u>332.4</u>	<u>293.0</u>	<u>625.3</u>
Total	<u>400.0</u>	<u>362.6</u>	<u>762.7</u>
Eastern Montana Totals			
Department of State Lands	79.5	49.9	129.4
Other public	75.6	84.3	160.0
Private	<u>1,005.4</u>	<u>574.6</u>	<u>1,580.0</u>
Total	<u>1,160.6</u>	<u>708.7</u>	<u>1,869.3</u>

*Indicates less than 50 acres.

Working Circle 4 This working circle was dominated by the ponderosa pine forest type. About 81 percent of the commercial timberland area was placed in the ponderosa pine forest type category (see Table 32).

There were only 5 forest types found in the working circle. The second most common forest type was Douglas-fir with 61,500 acres or 14 percent of the commercial timberland total.

Table 32. Area of commercial timberland by forest type and ownership group, Working Circle 4 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand acres-----				
Ponderosa pine	33.8	327.5	361.3	81.0
Douglas-fir	4.8	56.7	61.5	13.8
Lodgepole pine	0.5	5.7	6.2	1.4
Juniper	-	-	-	-
Whitebark-limber pine	-	-	-	-
Spruce	-	-	-	-
Softwood types	39.1	389.9	429.0	96.2
Cottonwood	0.2	3.6	3.7	0.8
Aspen	0.7	12.6	13.3	3.0
Mixed hardwoods	-	-	-	-
Hardwood types	0.8	16.2	17.0	3.8
All forest types	40.0	406.1	446.0	100.0

Working Circle 5 Ponderosa pine was the major forest type in the working circle with 54 percent of the commercial timberland acreage. Cottonwood and Douglas-fir were the next two most common forest types. Hardwood forest types comprised 22 percent of the commercial timberland acreage (see Table 33).

Working Circle 6 Douglas-fir was the most common forest type in the working circle with 46 percent of the commercial timberland acreage (see Table 34). Ponderosa pine was the second most common forest type with 40,300 acres, or 29 percent of the commercial acreage. This is the only working circle in eastern Montana that had a fairly significant component of lodgepole pine, with 14 percent of the commercial acreage. Hardwood forest types comprised the remaining 11 percent of the timberland.

Table 33. Area of commercial timberland by forest type and ownership group,
Working Circle 5 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand acres-----				
Ponderosa pine	4.1	41.8	45.9	54.1
Douglas-fir	1.0	9.0	10.0	11.8
Lodgepole pine	0.6	3.7	4.3	5.1
Juniper	0.2	3.2	3.5	4.1
Whitebark-limber pine	0.1	2.2	2.3	2.7
Spruce	-	-	-	-
Softwood types	6.1	59.8	65.9	77.8
Cottonwood	1.4	11.1	12.4	14.6
Aspen	1.0	4.6	5.6	6.6
Mixed hardwoods	0.1	0.8	0.8	1.0
Hardwood types	2.4	16.5	18.9	22.2
All forest types	8.5	76.3	84.8	100.0

Table 34. Area of commercial timberland by forest type and ownership group,
Working Circle 6 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand acres-----				
Ponderosa pine	3.0	37.3	40.3	28.9
Douglas-fir	4.5	60.0	64.6	46.2
Lodgepole pine	1.2	17.7	18.9	13.5
Juniper	-	-	-	-
Whitebark-limber pine	-	-	-	-
Spruce	-	-	-	-
Softwood types	8.8	115.0	123.8	88.6
Cottonwood	0.7	8.0	8.7	6.2
Aspen	0.4	5.4	5.9	4.2
Mixed hardwoods	0.1	1.3	1.4	1.0
Hardwood types	1.2	14.8	16.0	11.4
All forest types	10.0	129.8	139.8	100.0

Working Circle 7 Ponderosa pine was the most common commercial forest type in the working circle (41,300 acres) followed closely by the cottonwood type (35,600 acres). Together these two forest types totaled 86 percent of the sampled commercial timberland in the working circle. Hardwood forest types comprised 45 percent of the commercial acreage (see Table 35).

Working Circle 8 This working circle was dominated by the ponderosa pine forest type. About 79 percent of the commercial timberland area was in the ponderosa pine type (see Table 36). The second most common forest type was cottonwood with 14 percent of the sampled commercial acreage.

Table 35. Area of commercial timberland by forest type and ownership group, Working Circle 7 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand acres-----				
Ponderosa pine	19.9	21.4	41.3	45.9
Douglas-fir	1.5	2.6	4.1	4.5
Lodgepole pine	1.5	2.6	4.1	4.5
Juniper	-	-	-	-
Whitebark-limber pine	-	-	-	-
Spruce	-	-	-	-
Softwood types	22.9	26.5	49.4	54.9
Cottonwood	3.8	31.8	35.6	39.6
Aspen	2.4	2.5	4.9	5.5
Mixed hardwoods	-	-	-	-
Hardwood types	6.2	34.4	40.5	45.1
All forest types	29.0	60.9	89.9	100.0

Table 36. Area of commercial timberland by forest type and ownership group, Working Circle 8 (thousand acres).

Forest Type	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand acres-----			
Ponderosa pine	57.0	260.0	317.0	79.3
Douglas-fir	2.8	21.0	23.8	5.9
Lodgepole pine	0.2	3.5	3.7	0.9
Juniper	-	-	-	-
Whitebark-limber pine	-	-	-	-
Spruce	-	0.8	0.8	0.2
Softwood types	60.0	285.3	345.3	86.3
Cottonwood	7.7	47.1	54.7	13.7
Aspen	-	-	-	-
Mixed hardwoods	-	-	-	-
Hardwood types	7.7	47.1	54.7	13.7
All forest types	67.6	332.4	400.0	100.0

Timber Volume by Working Circle

Figures 9 and 10 show the cubic foot and board foot volumes for each working circle in eastern Montana. Working Circle 5 had the least amount of cubic foot and board foot volume among the working circles in eastern Montana. Working Circle 4 had the greatest amount of both cubic foot and board foot volume in eastern Montana.

The private ownership group had from 69 percent of the sampled cubic foot volume in Working Circle 7, up to 93 percent of the cubic foot volume in Working Circle 6. A similar relationship existed with the board foot volumes.

Figure 9. Net volume of growing stock by working circle, Working Circles 4, 5, 6, 7, and 8 (million cubic feet).

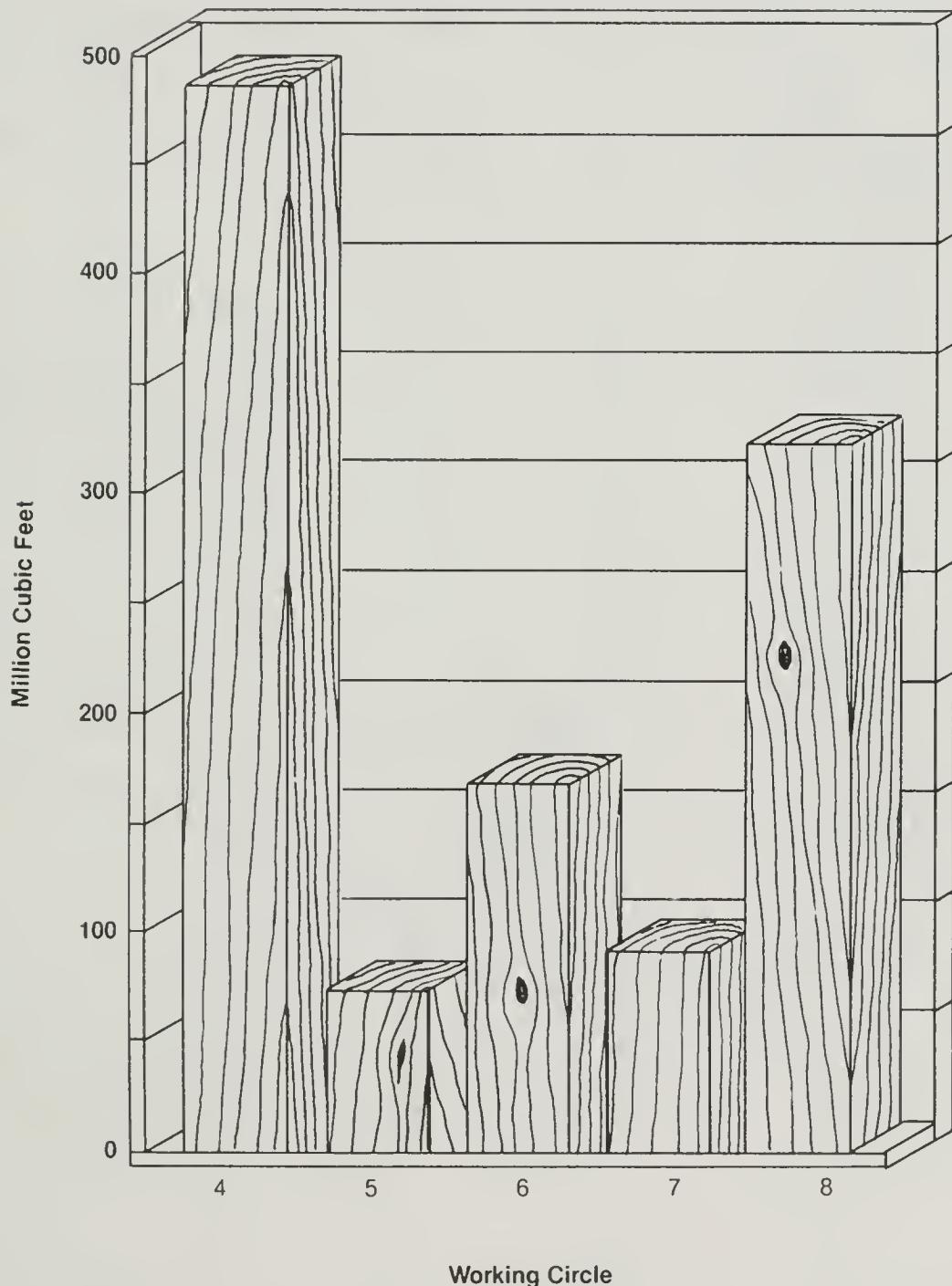
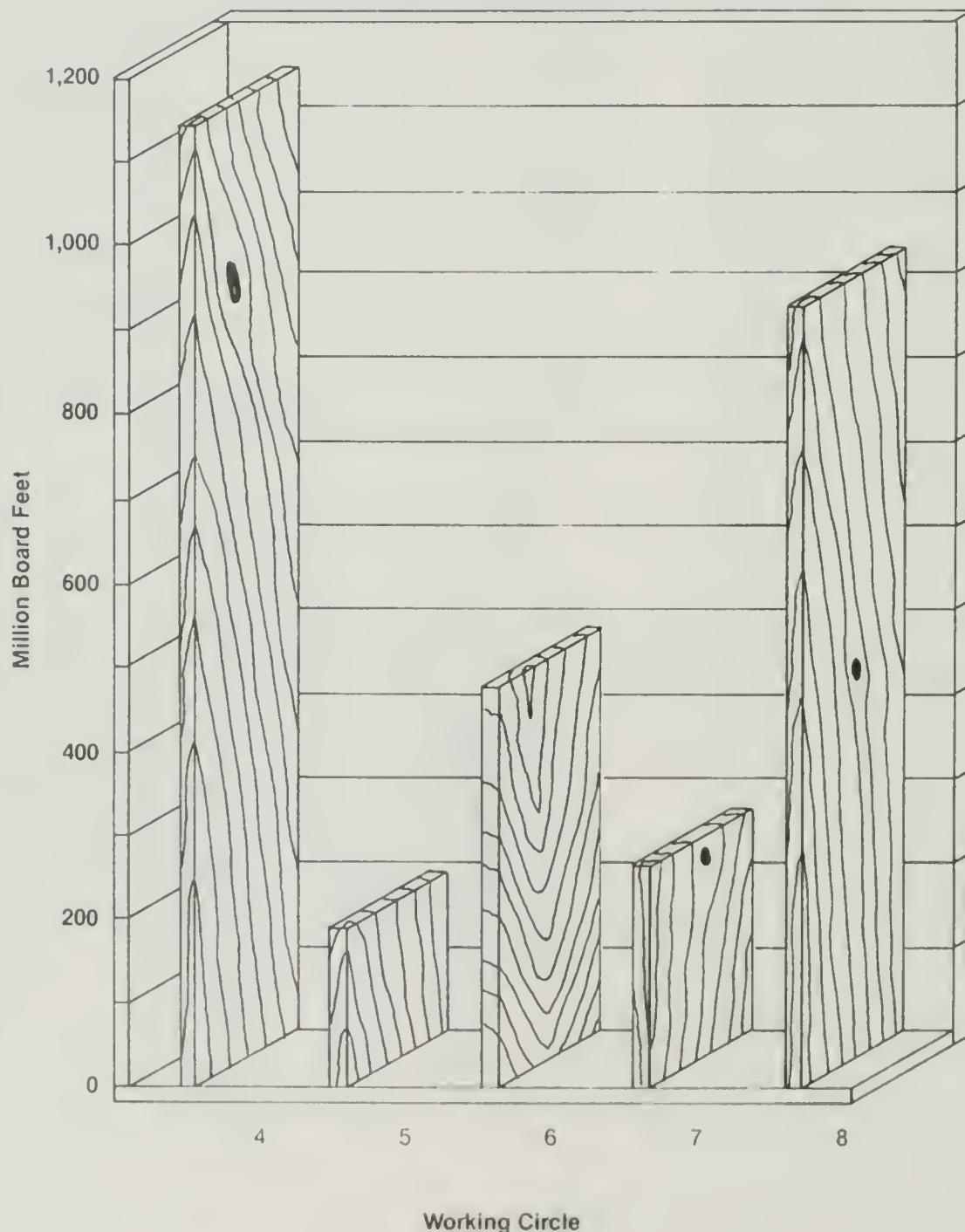


Figure 10. Net volume of sawtimber by working circle, Working Circles 4, 5, 6, 7, and 8 (million board feet Scribner).



Working Circle

Working Circle 4 Ninety-two percent of the volume found on sampled commercial timberland belonged to the private ownership group (see Tables 37 and 38).

Ponderosa pine comprised 74 percent of the cubic foot volume in the working circle and 76 percent of the board foot volume. Softwood species made up 95 percent of the cubic foot volume and 98 percent of the board foot volume found on commercial timberland in this working circle.

Table 37. Net volume of growing stock on commercial timberland by species and ownership group, Working Circle 4 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand cubic feet-----				
Ponderosa pine	31,910	327,237	359,147	73.9
Douglas-fir	5,772	68,202	73,974	15.2
Lodgepole pine	1,495	16,595	18,090	3.7
Whitebark-limber pine	120	1,503	1,624	0.3
Spruce	489	7,324	7,813	1.6
Subalpine fir	16	239	254	0.1
Softwood species	39,803	421,099	460,902	94.8
Cottonwood	197	4,433	4,630	1.0
Aspen	1,119	19,375	20,494	4.2
Other hardwoods	-	-	-	-
Hardwood species	1,316	23,809	25,124	5.2
Total all species	41,118	444,908	486,026	100.0

Table 38. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circle 4 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand board feet-----				
Ponderosa pine	77,057	795,931	872,988	76.2
Douglas-fir	15,672	187,170	202,842	17.7
Lodgepole pine	2,067	22,994	25,061	2.2
Whitebark-limber pine	-	-	-	-
Spruce	1,496	22,634	24,130	2.1
Subalpine fir	-	-	-	-
Softwood species	96,292	1,028,728	1,125,020	98.3
Cottonwood	805	18,113	18,919	1.7
Aspen	47	1,005	1,052	0.1
Other hardwoods	-	-	-	-
Hardwood species	853	19,118	19,971	1.7
Total all species	97,144	1,047,846	1,144,991	100.0

Working Circle 5 About 90 percent of the volume found on sampled commercial timberland belonged to the private ownership group (see Tables 39 and 40).

Ponderosa pine was the most common species in the working circle on a cubic foot basis (45 percent) and a board foot basis (48 percent). Cottonwood was the second most common species with 28 percent of the board foot volume and 20 percent of the cubic foot volume. Douglas-fir also had 20 percent of the cubic foot volume.

Table 39. Net volume of growing stock on commercial timberland by species and ownership group, Working Circle 5 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand cubic feet-----				
Ponderosa pine	3,047	29,279	32,325	44.6
Douglas-fir	1,500	12,964	14,464	20.0
Lodgepole pine	583	3,038	3,621	5.0
Whitebark-limber pine	93	1,473	1,565	2.2
Spruce	31	244	275	0.4
Subalpine fir	-	-	-	-
Softwood species	5,254	46,997	52,251	72.1
Cottonwood	1,560	12,916	14,476	20.0
Aspen	841	4,861	5,702	7.9
Other hardwoods	-	-	-	-
Hardwood species	2,400	17,777	20,178	27.9
Total all species	7,654	64,774	72,428	100.0

Table 40. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circle 5 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
-----thousand board feet-----				
Ponderosa pine	8,362	81,094	89,456	47.6
Douglas-fir	2,771	26,438	29,209	15.5
Lodgepole pine	1,459	6,994	8,453	4.5
Whitebark-limber pine	268	4,199	4,467	2.4
Spruce	112	892	1,005	0.5
Subalpine fir	-	-	-	-
Softwood species	12,974	119,616	132,590	70.6
Cottonwood	5,629	46,652	52,281	27.8
Aspen	373	2,616	2,989	1.6
Other hardwoods	-	-	-	-
Hardwood species	6,002	49,268	55,269	29.4
Total all species	18,976	168,884	187,860	100.0

Working Circle 6 The private ownership group owned an estimated 93 percent of the cubic foot and board foot volume found on sampled timberland in this working circle.

Douglas-fir was the most common species on a cubic foot basis (42 percent) and on a board foot basis (43 percent). Ninety percent of the volume estimated for this working circle was made up of softwood species (see Tables 41 and 42).

Table 41. Net volume of growing stock on commercial timberland by species and ownership group, Working Circle 6 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand cubic feet-----			
Ponderosa pine	2,344	29,779	32,123	19.3
Douglas-fir	4,663	64,764	69,427	41.7
Lodgepole pine	2,766	40,022	42,787	25.7
Whitebark-limber pine	327	4,557	4,884	2.9
Spruce	57	691	748	0.4
Subalpine fir	11	124	134	0.1
Softwood species	10,167	139,936	150,103	90.1
Cottonwood	947	11,134	12,081	7.2
Aspen	193	2,210	2,404	1.4
Other hardwoods	163	1,928	2,090	1.3
Hardwood species	1,303	15,272	16,574	9.9
Total all species	11,470	155,208	166,678	100.0

Table 42. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circle 6 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand board feet-----			
Ponderosa pine	7,995	102,096	110,091	23.0
Douglas-fir	13,783	193,368	207,151	43.3
Lodgepole pine	6,370	92,665	99,035	20.7
Whitebark-limber pine	714	10,177	10,890	2.3
Spruce	153	1,901	2,054	0.4
Subalpine fir	21	244	265	0.1
Softwood species	29,035	400,451	429,487	89.8
Cottonwood	3,416	40,224	43,640	9.1
Aspen	-	-	-	-
Other hardwoods	418	4,961	5,379	1.1
Hardwood species	3,834	45,185	49,019	10.2
Total all species	32,869	445,636	478,506	100.0

Working Circle 7 Seventy-three percent of the sampled board foot, and 69 percent of the cubic foot volume, was owned by the private ownership group (see Tables 43 and 44).

Cottonwood was the most common species on a cubic foot basis (43 percent) and on a board foot basis (57 percent). The second most common species was ponderosa pine. Hardwood species comprised 50 percent of the total cubic foot volume and 61 percent of the total board foot volume in the working circle.

Table 43. Net volume of growing stock on commercial timberland by species and ownership group, Working Circle 7 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand cubic feet-----			
Ponderosa pine	13,612	14,341	27,953	30.6
Douglas-fir	2,900	3,478	6,378	7.0
Lodgepole pine	4,600	6,777	11,377	12.4
Whitebark-limber pine	-	-	-	-
Spruce	-	-	-	-
Subalpine fir	-	-	-	-
Softwood species	21,113	24,596	45,708	50.0
Cottonwood	4,149	34,887	39,036	42.7
Aspen	3,244	3,453	6,696	7.3
Other hardwoods	-	-	-	-
Hardwood species	7,393	38,340	45,733	50.0
Total all species	28,505	62,936	91,441	100.0

Table 44. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circle 7 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand board feet-----			
Ponderosa pine	35,399	36,960	72,359	27.6
Douglas-fir	9,945	11,173	21,118	8.0
Lodgepole pine	4,019	4,776	8,795	3.4
Whitebark-limber pine	-	-	-	-
Spruce	-	-	-	-
Subalpine fir	-	-	-	-
Softwood species	49,363	52,909	102,272	39.0
Cottonwood	16,020	134,705	150,725	57.4
Aspen	4,558	4,851	9,409	3.6
Other hardwoods	-	-	-	-
Hardwood species	20,578	139,556	160,134	61.0
Total all species	69,941	192,465	262,406	100.0

Working Circle 8 The private ownership group owned 84 percent of the sampled volume in this working circle (see Tables 45 and 46).

Ponderosa pine was the most common species on a cubic foot basis, with 64 percent of the growing stock volume, and on a board foot basis, with 59 percent of the sawtimber volume. Cottonwood was the second most common species based on the volume sampled.

Table 45. Net volume of growing stock on commercial timberland by species and ownership group, Working Circle 8 (thousand cubic feet).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand cubic feet-----			
Ponderosa pine	37,623	169,006	206,630	64.2
Douglas-fir	4,701	36,918	41,620	12.9
Lodgepole pine	463	6,151	6,614	2.1
Whitebark-limber pine	93	3,638	3,731	1.2
Spruce	17	2,484	2,502	0.8
Subalpine fir	-	506	506	0.2
Softwood species	42,897	218,704	261,601	81.3
Cottonwood	8,436	51,910	60,346	18.7
Aspen	-	-	-	-
Other hardwoods	-	-	-	-
Hardwood species	8,436	51,910	60,346	18.7
Total all species	51,333	270,614	321,946	100.0

Table 46. Net volume of sawtimber on commercial timberland by species and ownership group, Working Circle 8 (thousand board feet Scribner).

Species	Ownership Group			Percentage of Total
	State and Other Public	Private	Total	
	-----thousand board feet-----			
Ponderosa pine	98,353	454,132	552,485	59.3
Douglas-fir	13,866	109,448	123,314	13.2
Lodgepole pine	928	9,355	10,283	1.1
Whitebark-limber pine	176	4,479	4,655	0.5
Spruce	67	6,738	6,805	0.7
Subalpine fir	-	734	734	0.1
Softwood species	113,391	584,886	698,277	75.0
Cottonwood	32,571	200,415	232,985	25.0
Aspen	-	-	-	-
Other hardwoods	-	-	-	-
Hardwood species	32,571	200,415	232,985	25.0
Total all species	145,962	785,302	931,263	100.0

Growth and Mortality

In eastern Montana, the amount of cubic foot growth in the working circles followed the amount of commercial timberland: Working Circle 4 had the most with 47 percent of the total, Working Circle 5 had the least with 4 percent of the total, etc. (see Table 47). Private land growth ranged from 56 percent of the total in Working Circle 7 to 93 percent of the total in Working Circle 6. Working Circle 8 had the most cubic foot and board foot growth on state and other public land. Working Circle 4 had more growth than Working Circle 8 on private land, especially on a board foot basis (see Table 48).

Working Circle 4 had the most mortality on both a cubic foot and board foot basis, followed by Working Circle 8. Working Circle 5, however, had the third most, almost as much as Working Circles 6 and 7 combined (see Tables 49 and 50). On state and other public land, there was more cubic foot mortality in Working Circle 8 than in any other working circle, but Working Circle 4 had the most on a board foot basis.

Table 47. Net annual growth of growing stock for softwood species on commercial timberland by working circle and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Working Circle	Ownership Group		
	State and Other Public	Private	Total
			-----thousand cubic feet-----
4	962	9,863	10,824
5	85	789	874
6	217	2,915	3,132
7	517	671	1,189
8	1,204	5,806	7,009
Total	2,984	20,044	23,028

Table 48. Net annual growth of sawtimber on commercial timberland for softwood species by working circle and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Working Circle	Ownership Group		
	State and Other Public	Private	Total
	-----thousand cubic feet-----		
4	3,295	34,292	37,588
5	371	3,433	3,804
6	831	11,535	12,366
7	1,240	1,365	2,605
8	3,768	18,885	22,653
Total	9,505	69,510	79,016

Table 49. Net annual mortality of growing stock on commercial timberland for softwood species by working circle and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand cubic feet).

Working Circle	Ownership Group		
	State and Other Public	Private	Total
	-----thousand cubic feet-----		
4	117	1,386	1,504
5	35	288	323
6	11	155	166
7	79	85	165
8	164	853	1,017
Total	406	2,769	3,175

Table 50. Net annual mortality of sawtimber on commercial timberland for softwood species by working circle and ownership group, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Working Circle	Ownership Group		
	State and Other Public	Private	Total
	-----thousand cubic feet-----		
4	261	3,000	3,261
5	73	625	698
6	32	439	471
7	125	133	258
8	220	1,123	1,343
Total	711	5,321	6,030

Grazable Forest Land Data

The timberland in Eastern Montana can also support livestock. If the condition of the grazable forest land was improved in each working circle, a substantial increase in the carrying capacity would be obtained.

In eastern Montana, there was more commercial timberland with the understory in the good condition class than in any other class (see Table 51). In Working Circle 8, though, there was more excellent than good grazable forest land, and in Working Circle 7 there was more fair than good. Grazable forest land in fair or poor condition need a re-evaluation of their stocking rates. Working Circle 4 had the most land in these classes, although it had no poor grazable forest land. Almost half of the grazable forest land in Working Circle 7 was in fair or poor condition, while just less than 18 percent of it in Working Circles 4 and 8 was in one of those conditions.

Working Circle 8 had more than half of the available animal unit months (AUM's) in the excellent and poor range condition classes at the time of inventory, and the most AUM's in the good and fair condition classes (see Table 52). Working Circle 6 had the fewest available AUM's in eastern Montana.

Table 53 gives the number of AUM's potentially available in each working circle if the understory on all of the commercial timberland were in excellent range condition. Working Circle 5 was the closest to its potential, but it could still improve by 28 percent. If all of the commercial timberland in Working Circle 7 were in excellent range condition, the carrying capacity could be increased by almost 80 percent! Working Circle 8 has the potential to carry the most AUM's in eastern Montana, and Working Circle 6 has the least.

Table 51. Area of commercial timberland by condition class and working circle, Working Circles 4, 5, 6, 7, and 8 (thousand acres).

Working Circle	Condition Class					Total*
	Excellent	Good	Fair	Poor		
	-----thousand acres-----					
4	136.5	189.7	70.6	-	396.8	
5	16.4	37.9	20.8	2.4	77.5	
6	30.0	40.0	17.0	2.8	89.8	
7	15.4	22.6	30.0	7.1	75.1	
8	176.5	130.8	53.1	13.1	375.5	
Total	374.9	421.0	191.5	25.4	1,012.7	

*The total does not include timberland with a crown density greater than 70 percent because the understory is considered to have no value for livestock.

Table 52. Available animal unit months (AUM's) on commercial timberland by condition class and working circle, Working Circles 4, 5, 6, 7, and 8.

Working Circle	Condition Class					Total
	Excellent	Good	Fair	Poor		
	-----AUM's-----					
4	24,248	18,445	6,509	-	49,203	
5	6,036	5,155	1,201	43	12,435	
6	3,527	3,737	1,709	251	9,223	
7	1,430	4,016	5,608	1,092	12,147	
8	37,802	22,815	9,461	1,726	71,804	
Total	73,043	54,168	24,488	3,112	154,811	

Table 53. Potential animal unit months (AUM's) on commercial timberland by crown density and working circle, Working Circles 4, 5, 6, 7, and 8.

Working Circle	Crown Density					Total
	10-30	31-50	51-70	71*		
	-----AUM's-----					
4	25,983	24,514	15,079	-	65,575	
5	5,710	7,126	3,066	-	15,900	
6	5,682	4,467	3,362	-	13,511	
7	15,628	4,434	1,687	-	21,749	
8	64,500	25,694	4,087	-	94,276	
Total	117,503	66,235	27,281	-	211,011	

*No range data was collected on forest land with greater than 70 percent crown density because the understory is considered to have no value for livestock.

CONCLUSIONS AND RECOMMENDATIONS

The Timberland's Grazable Resource

In 1980, approximately 87 percent (1,012,700 acres) of the sampled commercial timberland acreage had less than 71 percent crown density and, therefore, was considered grazable. The condition of the understory was estimated to be excellent or good on about 79 percent (795,900 acres) of the grazable commercial timberland. The current available carrying capacity was estimated to be 154,800 AUM's or about 73 percent of the potential available carrying capacity of 211,000 AUM's. It is necessary to re-evaluate the grazing practices on those acres experiencing a downward trend in range condition to keep the amount of acres in poor or fair condition from increasing.

The amount and location of grazable forest acreage changes from year to year as new stands are logged or burned and as crown densities in existing timber stands increase and block out the sun. In 1980, approximately 87 percent (1,012,700 acres) of the sampled commercial timberland acreage had less than 71 percent crown density and, therefore, was considered grazable. The condition of the forest understory was estimated to be excellent or good on about 79 percent of the grazable commercial timberland.

Overall, a total of 216,900 acres of the commercial timberland's understory were determined to be in fair or poor condition. If the ecological condition of the understory on these acres are not currently improving, their stocking rates probably need to be re-evaluated. Some of the grazable timberland that was rated as being in excellent or good condition could also be experiencing overgrazing. Over a period of time even land in excellent condition, if overgrazed, could deteriorate to a poor condition.

The current carrying capacity, defined by the inventory procedures as available animal unit months (AUM's), was estimated to be 154,800 AUM's. If every acre of grazable timberland were in excellent condition, the potential available carrying capacity would be 211,000 AUM's. The actual available carrying capacity was 73 percent of the potential available carrying capacity.

The objective of most grazing management programs is to make optimum use of forage resources while maintaining or improving these resources. It is clear, based on the data, that many acres have not been managed in a manner that would achieve this objective.

Land managers can improve overgrazed areas by simply reducing the amount of livestock. Land managers can also maintain or improve the grazing resource and optimize use through more aggressive management techniques that may include some or all of the following items: salting, herding (rotation grazing), fencing, increasing the number of trails, increasing water developments, and reducing slash, logging debris, and other mechanical barriers. Another obvious tactic that may conflict with timber objectives is to maintain lower crown densities or less canopy cover in those forest stands that are being grazed. This could be done by thinning precommercial material or by harvesting some commercial timber while still maintaining a crop of trees for future harvest.

Past Harvest Rates and Growth

Data covering a 15 year period shows timber harvesting has fluctuated wildly in eastern Montana. The average amount of timber harvested annually on private land from 1968 through 1982 was 14.9 million board feet. Working Circle 4 supplied 78 percent of the total volume harvested from private lands during the period. The annual average harvest from private land over the last 15 years is only 23 percent of the board foot net growth estimated for 1980.

Each year, the Forestry Division attempts to determine the amount of timber harvested on state and private lands. This amount is determined from state land records and hazard reduction agreements drawn between the state and logging operators. The board foot volume listed in Table 54 shows the amount of timber loaded on trucks and delivered to mills. Normally, the smallest trees delivered are in the 6-inch diameter class. In addition to the volume brought to the mills, a portion of the merchantable volume is left in the forest as logging residue. Based on figures reported by the USDA Forest Service (Wilson et al. 1970), the amount of residue left on the logging site is about 8 percent of the board foot volume delivered to the mills.

In 1980, the amount of timber removed from the private land inventory totaled 23.6 million board feet (this figure includes logging residues). The average volume of timber removed from the private land inventory since 1968 has been 16.1 million board feet Scribner annually. (This figure also includes logging residues.) The net annual board foot growth for sawtimber on private lands was estimated to be 69.1 million board feet Scribner in 1980. Subtracting the harvested volume from net growth shows the standing inventory of timber was increased by 45.5 million board feet. In other words, harvesting in 1980 occurred at a rate that was 34 percent of sawtimber board foot growth.

The erratic annual harvests in eastern Montana make a one year comparison of annual harvest to annual net growth less useful than it might be for areas with more stable harvest histories. Consequently, a comparison of the average annual harvest for the 15-year period is probably more meaningful.

Data covering a 15-year cutting period (see Table 54 and Figure 11) shows timber harvesting on private lands has fluctuated wildly from 1968 through 1982. The average amount of timber harvested on private land in eastern Montana over the 15 years was 14.9 million board feet. (Working Circle 4 supplied 78 percent of the total volume of timber harvested from private lands during the period). If logging residues are considered the average annual harvest was 16.1 million board feet or only 23 percent of the softwood board foot net growth estimated for 1980.

Figure 11. Volume of sawtimber cut from private lands, calendar years 1968 through 1982, by working circle, Working Circles 4, 5, 6, 7, and 8 (million board feet Scribner).

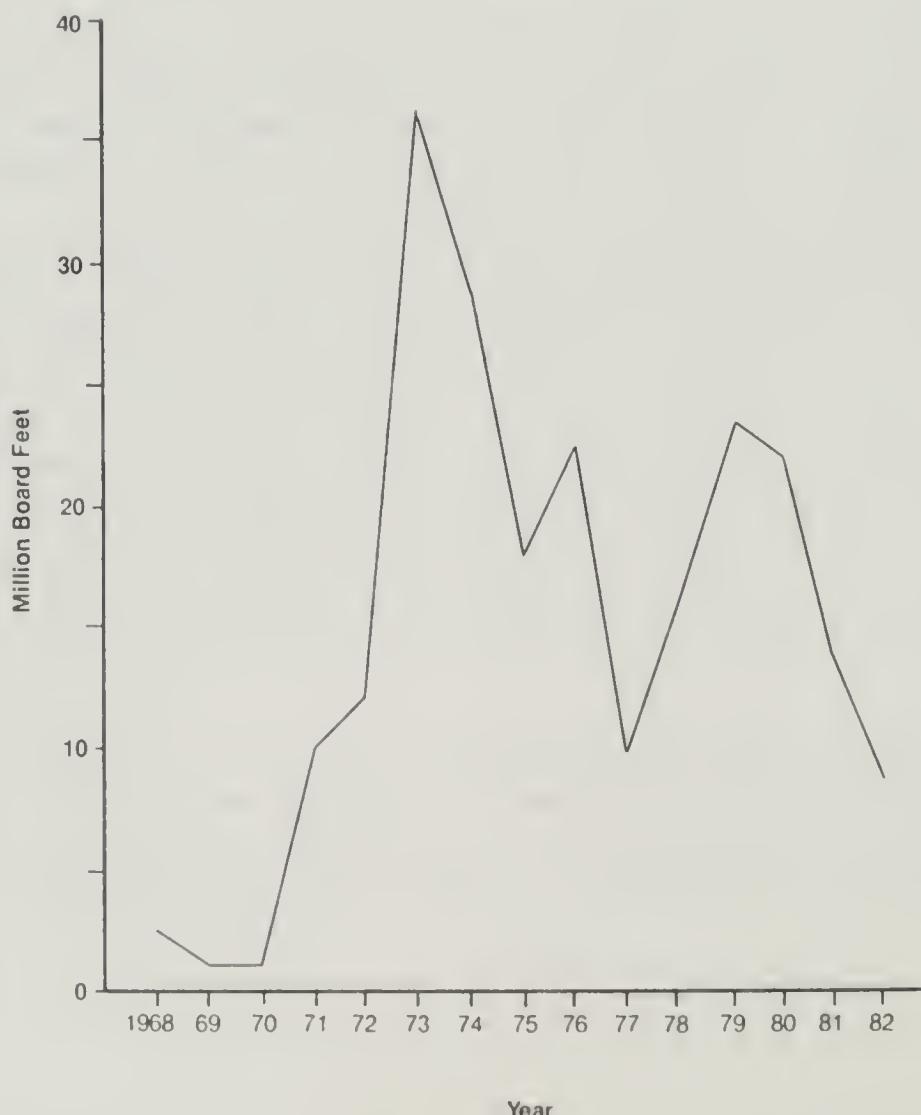


Table 54. Volume of sawtimber cut from private lands, calendar years 1968 through 1982, by working circle, Working Circles 4, 5, 6, 7, and 8 (thousand board feet Scribner).

Year	Working Circle 4	Working Circle 5	Working Circle 6	Working Circle 7	Working Circle 8	Eastern Montana Total
-----thousand board feet-----						
1968	1,550	-	735	-	-	2,285
1969	925	-	218	-	-	1,143
1970	798	-	285	-	-	1,082
1971	9,773	-	-	-	-	9,783
1972	11,250	215	5	-	218	12,006
1973	29,983	189	279	26	4,792	36,210
1974	21,112	149	80	-	1,327	28,758
1975	15,506	146	1,867	24	-	17,838
1976	20,642	14	545	-	-	22,494
1977	7,839	-	283	-	-	9,459
1978	11,293	130	2,122	-	-	15,827
1979	16,957	249	3,863	-	-	23,262
1980	13,409	507	1,329	365	1,000	21,883
1981	7,149	618	2,062	41	-	13,310
1982	5,996	198	526	-	-	8,348
Total	174,182	2,415	14,198	456	7,337	223,687
15 Year Average	11,612	161	947	30	489	14,913

Timber Management In Eastern Montana

The outlook for the future timber supply in eastern Montana is good. There appears to be plenty of standing volume and growth to meet the demand that has occurred historically.

Timber management can be practiced in eastern Montana and probably should be on many of the commercial timberland acres. Much of the timberland area should be managed to produce both forest products and livestock.

The outlook for the future timber supply in eastern Montana is good. There appears to be plenty of standing volume and growth to meet the demand that has occurred historically.

If demand did increase dramatically, and it was desirable to increase production, the data does indicate an increase would be physically possible. Net growth was estimated to be 59 percent of potential net growth. The silvicultural treatment opportunities analysis indicated 60 percent of the commercial timberland area offered treatment opportunities that would improve the forest's condition and ultimately increase timber yields.

Unfortunately, the economics of applying some of the silvicultural treatments to the timberlands may prohibit them from being feasible. Evidence of this situation is shown by the timberland quality class analysis. An estimated 83 percent of the commercial softwood timberland was rated as fair for timber production.

In conclusion, timber management can be practiced in eastern Montana and probably should be on many of the commercial timberland acres. Much of the timberland area should be managed to produce both forest products and livestock.

APPENDIX 1. DATA RELIABILITY

The sampling errors presented in Tables 55 through 62 are calculated for one standard error -- the 67 percent confidence level. In other words, in two-out-of-three times, the actual value will be within the specified confidence interval. Individual cells within tables should be used with caution. Some of the data presented in other tables are based on small sample sizes and as a result have high sampling errors. For example, the percent error for individual forest type acreages within the commercial timberland total in Working Circle 4 will all have a higher error than 4.8 percent (see Table 55).

Table 55. Forest land area and associated sampling error percentages, Working Circle 4.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	429,037	±5.0%	16,992	±38.0%	446,029	±4.8%
Other forest land	147,054	±13.4%	10,253	±49.2%	157,307	±12.9%

Table 56. Net volume, net annual growth, and annual mortality on commercial timberland, with associated sampling error percentages, Working Circle 4.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing stock	406,902	±8.2%	25,124	±38.7%	486,026	±7.8%
(thousand cubic feet)						
Sawtimber	1,125,020	±9.3%	19,971	±94.4%	1,144,991	±9.3%
(MBF Scribner)						
Net Growth:						
Growing stock	10,824	±9.1%	757	±42.4%	11,582	±9.0%
(thousand cubic feet)						
Sawtimber	37,588	±9.9%	197	±93.1%	37,785	±9.8%
(MBF Scribner)						
Mortality:						
Growing stock	1,504	±27.8%	71	±63.3%	1,575	±26.3%
(thousand cubic feet)						
Sawtimber	3,261	±36.1%	-	-	3,261	±36.1%
(MBF Scribner)						

Table 57. Forest land area and associated sampling error percentages, Working Circle 5.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	65,892	±8.0%	18,913	±18.6%	84,806	±5.9%
Other forest land	18,083	±17.9%	8,904	±29.8%	26,987	±14.9%

Table 58. Net volume, net annual growth, and annual mortality on commercial timberland with associated sampling error percentages, Working Circle 5.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing stock (thousand cubic feet)	52,251	±14.7%	20,178	±23.4%	72,428	±11.1%
Sawtimber (MBF Scribner)	132,590	±14.7%	55,269	±28.5%	187,860	±12.2%
Net Growth:						
Growing stock (thousand cubic feet)	874	±20.7%	605	±33.8%	1,479	±17.2%
Sawtimber (MBF Scribner)	3,804	±23.3%	1,135	±39.7%	4,939	±19.8%
Mortality:						
Growing stock (thousand cubic feet)	323	±24.8%	78	±35.4%	401	±20.8%
Sawtimber (MBF Scribner)	698	±34.3%	170	±42.1%	867	±29.0%

Table 59. Forest land area and associated sampling error percentages, Working Circle 6.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	123,805	±6.1%	15,979	±26.9%	139,784	±5.4%
Other forest land	27,670	±19.4%	31,957	±13.9%	59,628	±11.5%

Table 60. Net volume, net annual growth, and annual mortality on commercial timberland with associated sampling error percentages, Working Circle 6.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing stock (thousand cubic feet)	150,103	±13.6%	16,574	±29.7%	166,678	±12.6%
Sawtimber (MBF Scribner)	429,487	±17.7%	49,019	±38.6%	478,506	±16.5%
Net Growth:						
Growing stock (thousand cubic feet)	3,132	±15.9%	316	±25.3%	3,448	±14.7%
Sawtimber (MBF Scribner)	12,366	±22.1%	938	±34.7%	13,304	±20.7%
Mortality:						
Growing stock (thousand cubic feet)	166	±52.9%	20	±100.0%	186	±48.2%
Sawtimber (MBF Scribner)	471	±56.4%	-	-	471	±56.4%

Table 61. Forest land area and associated sampling error percentages, Working Circles 7 and 8.

Item	Softwood Types		Hardwood Types		All Types	
	Acres	Error	Acres	Error	Acres	Error
Commercial timberland	394,743	±9.2%	95,222	±14.1%	489,964	±7.9%
Other forest land	441,446	±8.6%	23,377	±50.3%	464,822	±8.4%

Table 62. Net volume, net annual growth, and annual mortality on commercial timberland with associated sampling error percentages, Working Circles 7 and 8.

Item	Softwood Species		Hardwood Species		All Species	
	Volume	Error	Volume	Error	Volume	Error
Volume:						
Growing stock (thousand cubic feet)	307,309	±10.6%	106,078	±19.1%	413,387	±9.4%
Sawtimber (MBF Scribner)	800,549	±11.0%	393,118	±18.3%	1,193,667	±9.6%
Net Growth:						
Growing stock (thousand cubic feet)	8,198	±16.3%	1,463	±55.6%	9,661	±16.2%
Sawtimber (MBF Scribner)	25,258	±12.2%	7,447	±50.8%	32,706	±14.4%
Mortality:						
Growing stock (thousand cubic feet)	1,182	±35.9%	926	±53.3%	2,109	±31.2%
Sawtimber (MBF Scribner)	1,601	±37.1%	2,930	±67.2%	4,531	±43.4%

APPENDIX 2. ADDITIONAL DATA BY COUNTY

Table 63. Area of commercial timberland by county, softwood and hardwood forest types, and ownership group, Working Circle 4 (thousand acres).

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
Fergus					
Softwood types	12.2	0.2	144.6	157.0	92.6
Hardwood types	0.7	-	11.8	12.5	7.4
Total	12.9	0.2	156.4	169.5	100.0
Golden Valley					
Softwood types	1.6	-	23.8	25.4	96.9
Hardwood types	0.1	-	0.7	0.8	3.1
Total	1.7	-	24.5	26.2	100.0
Judith Basin					
Softwood types	1.0	0.2	14.5	15.7	94.6
Hardwood types	*	*	0.9	0.9	5.4
Total	1.0	0.2	15.4	16.6	100.0
Musselshell					
Softwood types	13.3	5.4	179.3	198.0	99.6
Hardwood types	-	-	0.7	0.7	0.4
Total	13.3	5.4	180.0	198.7	100.0
Petroleum					
Softwood types	2.7	1.6	15.5	19.8	98.5
Hardwood types	-	*	0.3	0.3	1.5
Total	2.7	1.6	15.8	20.1	100.0
Wheatland					
Softwood types	0.7	0.3	12.1	13.1	87.3
Hardwood types	*	-	1.9	1.9	12.7
Total	0.7	0.3	13.9	14.9	100.0
Working Circle Total					
Softwood types	31.5	7.7	389.9	429.0	96.2
Hardwood types	0.8	*	16.2	17.0	3.8
Total	32.2	7.7	406.1	446.0	100.0

*Indicates less than 50 acres.

Table 64. Area of commercial timberland by county, softwood and hardwood types, and ownership group, Working Circle 5 (thousand acres).

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
Carbon					
Softwood types	3.0	0.2	25.6	28.8	72.7
Hardwood types	1.2	0.6	9.1	10.8	27.3
Total	4.2	0.8	34.6	39.7	100.0
Stillwater					
Softwood types	2.6	0.2	34.2	37.1	82.1
Hardwood types	0.4	0.3	7.4	8.1	17.9
Total	3.0	0.5	41.7	45.1	100.0
Working Circle Total					
Softwood types	5.6	0.5	59.8	65.9	77.7
Hardwood types	1.6	0.8	16.5	18.9	22.3
Total	7.2	1.3	76.3	84.8	100.0

Table 65. Area of commercial timberland by county, softwood and hardwood types, and ownership group, Working Circle 6 (thousand acres).

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
-----thousand acres-----					
Cascade					
Softwood types	4.8	-	79.4	84.1	92.4
Hardwood types	0.3	0.2	6.3	6.9	7.6
Total	5.1	0.2	85.7	91.0	100.0
Chouteau					
Softwood types	1.2	-	17.3	18.6	86.1
Hardwood types	0.1	-	2.9	3.0	13.9
Total	1.3	-	20.3	21.6	100.0
Glacier					
Softwood types	-	*	5.2	5.2	83.9
Hardwood types	-	*	1.0	1.0	16.1
Total	-	*	6.2	6.2	100.0
Pondera					
Softwood types	1.5	-	2.4	3.8	73.1
Hardwood types	0.1	-	1.3	1.4	26.9
Total	1.6	-	3.7	5.2	100.0
Teton					
Softwood types	0.9	0.5	9.7	11.1	78.2
Hardwood types	0.4	*	2.7	3.1	21.8
Total	1.3	0.6	12.4	14.2	100.0
Toole					
Softwood types	-	-	1.0	1.0	62.5
Hardwood types	-	-	0.6	0.6	37.5
Total	-	-	1.5	1.5	100.0
Working Circle Total					
Softwood types	8.2	0.5	114.9	123.8	88.6
Hardwood types	1.0	0.2	14.8	16.0	11.4
Total	9.2	0.8	129.7	139.8	100.0

*Indicates less than 50 acres.

Table 66. Area of commercial timberland by county, softwood and hardwood types, and ownership group, Working Circle 7 (thousand acres).

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
Blaine					
Softwood types	1.5	-	6.6	8.1	63.3
Hardwood types	0.6	-	4.2	4.7	36.7
Total	2.1	-	10.8	12.9	100.0
Daniels					
Softwood types	-	-	-	-	-
Hardwood types	-	-	-	-	-
Total	-	-	-	-	-
Garfield					
Softwood types	1.7	15.6	12.8	30.0	87.5
Hardwood types	0.1	1.8	2.4	4.3	12.5
Total	1.8	17.4	15.1	34.3	100.0
Hill					
Softwood types	0.5	-	3.4	3.9	63.9
Hardwood types	0.3	0.4	1.4	2.2	36.1
Total	0.8	0.4	4.9	6.1	100.0
Liberty					
Softwood types	0.4	0.2	0.5	1.1	42.3
Hardwood types	0.2	-	1.3	1.5	57.7
Total	0.6	0.2	1.8	2.7	100.0
McCone					
Softwood types	-	-	-	-	-
Hardwood types	-	-	2.4	2.4	100.0
Total	-	-	2.4	2.4	100.0
Phillips					
Softwood types	0.9	1.7	3.0	5.7	58.2
Hardwood types	0.3	0.4	3.4	4.1	41.8
Total	1.2	2.1	6.5	9.8	100.0
Richland					
Softwood types	-	-	0.1	0.1	1.1
Hardwood types	-	0.6	8.6	9.2	98.9
Total	-	0.6	8.7	9.3	100.0
Roosevelt					
Softwood types	-	-	-	-	-
Hardwood types	-	0.4	3.7	4.1	100.0
Total	-	0.4	3.7	4.1	100.0

Table 66.
(Page 2)

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
Sheridan					
Softwood types	-	-	-	-	-
Hardwood types	-	-	-	-	-
Total	-	-	-	-	-
Valley					
Softwood types	-	0.4	0.1	0.5	6.0
Hardwood types	0.4	0.5	7.0	7.9	94.0
Total	0.4	0.9	7.1	8.4	100.0
Working Circle Total					
Softwood types	5.0	17.9	26.5	49.4	54.9
Hardwood types	1.9	4.2	34.4	40.5	45.1
Total	6.9	22.1	60.9	89.9	100.0

Table 67. Area of commercial timberland by county, softwood and hardwood types, and ownership group, Working Circle 8 (thousand acres).

County and Forest Type	Owner				Percentage of Total
	DSL	Other Public	Private	Total	
Big Horn					
Softwood types	2.2	1.3	46.1	49.5	88.2
Hardwood types	0.1	-	6.5	6.6	11.8
Total	2.3	1.3	52.5	56.1	100.0
Carter					
Softwood types	1.5	1.6	11.6	14.6	84.9
Hardwood types	-	0.1	2.5	2.6	15.1
Total	1.5	1.7	14.1	17.3	100.0
Custer					
Softwood types	2.6	5.7	23.1	31.4	82.2
Hardwood types	0.4	0.7	5.6	6.8	17.8
Total	3.0	6.4	28.7	38.1	100.0
Dawson					
Softwood types	-	0.6	0.8	1.4	26.9
Hardwood types	0.1	0.7	3.0	3.8	73.1
Total	0.1	1.3	3.8	5.2	100.0
Fallon					
Softwood types	-	0.1	0.5	0.5	33.3
Hardwood types	0.1	-	0.9	0.9	66.7
Total	0.1	0.1	1.4	1.5	100.0

Table 67.
(Page 2)

County and Forest Type	Owner			Percentage of Total	
	DSL	Other Public	Private		
<hr/>					
Powder River		thousand acres			
Softwood types	4.3	11.0	29.6	44.9	
Hardwood types	0.4	0.9	9.0	10.4	
Total	<u>4.7</u>	<u>12.0</u>	<u>38.6</u>	<u>55.3</u>	
				100.0	
<hr/>					
Prairie					
Softwood types	0.1	0.7	0.3	1.1	
Hardwood types	-	0.1	0.3	0.4	
Total	<u>0.1</u>	<u>0.8</u>	<u>0.6</u>	<u>1.5</u>	
				100.0	
<hr/>					
Rosebud					
Softwood types	3.8	7.2	58.4	69.4	
Hardwood types	0.5	0.2	5.8	6.4	
Total	<u>4.3</u>	<u>7.4</u>	<u>64.2</u>	<u>75.9</u>	
				100.0	
<hr/>					
Sweet Grass					
Softwood types	2.8	4.2	54.3	61.3	
Hardwood types	0.3	0.6	4.4	5.4	
Total	<u>3.1</u>	<u>4.9</u>	<u>58.7</u>	<u>66.7</u>	
				100.0	
<hr/>					
Treasure					
Softwood types	1.5	0.8	17.4	19.7	
Hardwood types	0.1	-	4.2	4.3	
Total	<u>1.6</u>	<u>0.8</u>	<u>21.5</u>	<u>23.9</u>	
				100.0	
<hr/>					
Wibaux					
Softwood types	-	0.3	0.5	0.8	
Hardwood types	0.1	0.1	0.2	0.4	
Total	<u>0.1</u>	<u>0.4</u>	<u>0.7</u>	<u>1.2</u>	
				100.0	
<hr/>					
Yellowstone					
Softwood types	2.7	5.1	42.9	50.7	
Hardwood types	0.2	1.8	4.7	6.6	
Total	<u>2.9</u>	<u>6.8</u>	<u>47.5</u>	<u>57.3</u>	
				100.0	
<hr/>					
Working Circle Total					
Softwood types	21.5	38.5	285.3	345.3	
Hardwood types	2.4	5.2	47.1	54.7	
Total	<u>23.9</u>	<u>43.7</u>	<u>332.4</u>	<u>400.0</u>	
				100.0	

Table 68. Net volume of growing stock on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 4 (thousand cubic feet).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
----- thousand cubic feet -----					
Fergus					
Softwood species	17,957	250	212,919	231,126	92.6
Hardwood species	1,037	3	17,431	18,471	7.4
Total all species	18,995	252	230,350	249,597	100.0
Golden Valley					
Softwood species	2,184	-	32,649	34,832	96.6
Hardwood species	92	-	1,148	1,240	3.4
Total all species	2,276	-	33,796	36,072	100.0
Judith Basin					
Softwood species	1,707	264	21,645	23,616	94.2
Hardwood species	51	10	1,388	1,450	5.8
Total all species	1,758	274	23,034	25,066	100.0
Musselshell					
Softwood species	9,474	3,649	125,958	139,081	99.4
Hardwood species	-	-	873	873	0.6
Hardwood species	9,474	3,649	126,831	139,954	100.0
Petroleum					
Softwood species	1,825	1,050	10,113	12,988	97.1
Hardwood species	-	42	349	391	2.9
Total all species	1,825	1,092	10,462	13,379	100.0
Wheatland					
Softwood species	946	498	17,815	19,259	87.7
Hardwood species	64	16	2,620	2,700	12.3
Total all species	1,010	514	20,435	21,958	100.0
Working Circle Total					
Softwood species	34,093	5,710	421,099	460,902	94.8
Hardwood species	1,244	72	23,808	25,124	5.2
Total all species	35,338	5,780	444,908	486,026	100.0

Table 69. Net volume of growing stock on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 5 (thousand cubic feet).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Carbon					
Softwood species	2,824	208	20,511	23,542	67.7
Hardwood species	1,015	656	9,583	11,254	32.3
Total all species	3,840	863	30,094	34,797	100.0
Stillwater					
Softwood species	2,070	152	26,486	28,708	76.3
Hardwood species	419	310	8,194	8,923	23.7
Total all species	2,489	462	34,681	37,631	100.0
Working Circle Total					
Softwood species	4,894	360	46,997	52,251	72.1
Hardwood species	1,434	966	17,777	20,178	27.9
Total all species	6,329	1,325	64,774	72,428	100.0

Table 70. Net volume of growing stock on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 6 (thousand cubic feet).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
-----thousand cubic feet-----					
Cascade					
Softwood species	5,701	-	94,862	100,563	93.6
Hardwood species	320	228	6,346	6,894	6.4
Total all species	6,021	229	101,207	107,457	100.0
Chouteau					
Softwood species	1,106	-	22,908	24,014	88.7
Hardwood species	119	-	2,945	3,064	11.3
Total all species	1,225	-	25,853	27,078	100.0
Glacier					
Softwood species	-	8	6,667	6,675	86.2
Hardwood species	-	11	1,057	1,068	13.8
Total all species	-	19	7,723	7,743	100.0
Pondera					
Softwood species	1,762	-	3,092	4,854	76.3
Hardwood species	94	-	1,413	1,507	23.7
Total all species	1,856	-	4,505	6,361	100.0
Teton					
Softwood species	822	768	10,910	12,500	78.6
Hardwood species	499	32	2,863	3,394	21.4
Total all species	1,321	800	13,773	15,894	100.0
Toole					
Softwood species	-	-	1,498	1,498	69.8
Hardwood species	-	-	648	648	30.2
Total all species	-	-	2,146	2,146	100.0
Working Circle Total					
Softwood species	9,391	776	139,936	150,103	90.0
Hardwood species	1,032	271	15,272	16,574	10.0
Total all species	10,423	1,047	155,208	166,678	100.0

Table 71. Net volume of growing stock on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 7 (thousand cubic feet).

County and Species	Ownership Group				Percentage of Total	
	DSL	Other		Total		
		Public	Private			
Blaine		thousand cubic feet				
Softwood species	1,400	-	5,758	7,158	57.3	
Hardwood species	637	-	4,706	5,343	42.7	
Total all species	2,037	-	10,465	12,502	100.0	
Daniels						
Softwood species	-	-	-	-	-	
Hardwood species	-	-	-	-	-	
Total all species	-	-	-	-	-	
Garfield						
Softwood species	1,477	14,345	11,837	27,659	83.4	
Hardwood species	185	2,413	2,924	5,522	16.6	
Total all species	1,662	16,758	14,761	33,181	100.0	
Hill						
Softwood species	487	-	3,394	3,881	60.7	
Hardwood species	376	453	1,681	2,510	39.3	
Total all species	863	454	5,076	6,393	100.0	
Liberty						
Softwood species	425	295	554	1,274	42.6	
Hardwood species	267	-	1,453	1,720	57.4	
Total all species	691	296	2,007	2,994	100.0	
McCone						
Softwood species	-	-	-	-	-	
Hardwood species	-	-	2,617	2,617	100.0	
Total all species	-	-	2,617	2,617	100.0	
Phillips						
Softwood species	897	1,492	2,933	5,322	53.3	
Hardwood species	337	522	3,809	4,668	46.7	
Total all species	1,234	2,014	6,743	9,991	100.0	
Richland						
Softwood species	-	-	27	27	0.3	
Hardwood species	-	705	9,408	10,113	99.7	
Total all species	-	705	9,435	10,140	100.0	
Roosevelt						
Softwood species	-	-	-	-	-	
Hardwood species	-	467	4,049	4,516	100.0	
Total all species	-	467	4,049	4,516	100.0	

Table 71.

(Page 2)

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Sheridan		thousand cubic feet			
Softwood species	-	-	-	-	-
Hardwood species	-	-	-	-	-
Total all species	-	-	-	-	-
Valley					
Softwood species	-	294	91	385	4.2
Hardwood species	464	566	7,692	8,722	95.8
Total all species	464	860	7,783	9,107	100.0
Working Circle Total					
Softwood species	4,686	16,427	24,596	45,708	50.0
Hardwood species	2,266	5,127	38,340	45,733	50.0
Total all species	6,951	21,554	62,936	91,441	100.0

Table 72. Net volume of growing stock on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 8 (thousand cubic feet).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Big Horn		thousand cubic feet			
Softwood species	1,373	720	28,615	30,708	81.0
Hardwood species	120	-	7,069	7,189	19.0
Total all species	1,493	720	35,684	37,897	100.0
Carter					
Softwood species	1,032	1,105	8,184	10,321	78.1
Hardwood species	-	115	2,786	2,901	21.9
Total all species	1,032	1,221	10,970	13,222	100.0
Custer					
Softwood species	1,798	3,915	15,989	21,702	74.5
Hardwood species	453	790	6,180	7,423	25.5
Total all species	2,250	4,705	22,169	29,125	100.0
Dawson					
Softwood species	-	399	581	980	19.0
Hardwood species	109	811	3,270	4,190	81.0
Total all species	109	1,210	3,851	5,170	100.0
Fallon					
Softwood species	-	41	270	311	21.8
Hardwood species	110	-	1,007	1,117	78.2
Total all species	110	41	1,277	1,428	100.0

Table 72.

(Page 2)

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Powder River					
Softwood species	2,972	7,428	20,077	30,477	72.8
Hardwood species	470	1,028	9,879	11,377	27.2
Total all species	3,442	8,456	29,956	41,854	100.0
Prairie					
Softwood species	94	419	182	695	60.7
Hardwood species	-	113	337	450	39.3
Total all species	94	532	519	1,145	100.0
Rosebud					
Softwood species	2,341	4,586	35,654	42,581	85.8
Hardwood species	560	182	6,314	7,056	14.2
Total all species	2,901	4,768	41,969	49,637	100.0
Sweet Grass					
Softwood species	3,132	5,134	71,706	79,972	92.7
Hardwood species	367	723	5,197	6,287	7.3
Total all species	3,499	5,857	76,903	86,259	100.0
Treasure					
Softwood species	913	501	10,202	11,615	71.3
Hardwood species	118	-	4,550	4,668	28.7
Total all species	1,030	501	14,751	16,283	100.0
Wibaux					
Softwood species	-	178	290	468	51.1
Hardwood species	115	106	226	447	48.9
Total all species	115	284	516	915	100.0
Yellowstone					
Softwood species	1,723	3,095	26,953	31,771	81.4
Hardwood species	236	1,910	5,095	7,241	18.6
Total all species	1,959	5,005	32,048	39,012	100.0
Working Circle Total					
Softwood species	15,378	27,519	218,704	261,601	81.3
Hardwood species	2,658	5,778	51,910	60,346	18.7
Total all species	18,034	33,299	270,614	321,946	100.0

Table 73. Net volume of sawtimber on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 4 (thousand board feet Scribner).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Fergus					
Softwood species	44,835	619	533,132	578,585	99.2
Hardwood species	260	-	4,655	4,916	0.8
Total all species	<u>45,095</u>	<u>619</u>	<u>537,787</u>	<u>583,501</u>	<u>100.0</u>
Golden Valley					
Softwood species	5,736	-	84,584	90,320	97.9
Hardwood species	216	-	1,676	1,891	2.1
Total all species	<u>5,951</u>	<u>-</u>	<u>86,260</u>	<u>92,211</u>	<u>100.0</u>
Judith Basin					
Softwood species	3,868	692	53,538	58,097	97.5
Hardwood species	-	-	1,507	1,507	2.5
Total all species	<u>3,868</u>	<u>692</u>	<u>55,045</u>	<u>59,604</u>	<u>100.0</u>
Musselshell					
Softwood species	21,855	8,409	290,121	320,384	98.9
Hardwood species	-	-	3,567	3,567	1.1
Total all species	<u>21,855</u>	<u>8,409</u>	<u>293,688</u>	<u>323,952</u>	<u>100.0</u>
Petroleum					
Softwood species	4,230	2,450	23,482	30,162	95.0
Hardwood species	-	172	1,426	1,598	5.0
Total all species	<u>4,230</u>	<u>2,622</u>	<u>24,907</u>	<u>31,760</u>	<u>100.0</u>
Wheatland					
Softwood species	2,422	1,178	43,873	47,472	88.0
Hardwood species	205	-	6,287	6,492	12.0
Total all species	<u>2,626</u>	<u>1,178</u>	<u>50,160</u>	<u>53,964</u>	<u>100.0</u>
Working Circle Total					
Softwood species	82,945	13,347	1,028,728	1,125,020	98.3
Hardwood species	681	172	19,118	19,971	1.7
Total all species	<u>83,625</u>	<u>13,519</u>	<u>1,047,846</u>	<u>1,144,991</u>	<u>100.0</u>

Table 74. Net volume of sawtimber on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 5 (thousand board feet Scribner).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Carbon					
Softwood species	6,843	523	51,722	59,087	66.1
Hardwood species	1,920	2,201	26,197	30,317	33.9
Total all species	8,763	2,723	77,919	89,405	100.0
Stillwater					
Softwood species	5,186	422	67,895	73,503	74.7
Hardwood species	847	1,034	23,071	24,952	25.3
Total all species	6,033	1,456	90,965	98,455	100.0
Working Circle Total					
Softwoods	12,029	945	119,616	132,590	70.6
Hardwoods	2,767	3,235	49,268	55,270	29.4
Total all species	14,796	4,180	168,884	187,860	100.0

Table 75. Net volume of sawtimber on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 6 (thousand board feet Scribner).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Cascade					
Softwood species	16,237	-	270,169	286,406	93.2
Hardwood species	905	811	19,318	21,034	6.8
Total all species	17,142	811	289,487	307,440	100.0
Chouteau					
Softwood species	3,076	-	66,007	69,082	88.1
Hardwood species	401	-	8,893	9,294	11.9
Total all species	3,477	-	74,899	78,376	100.0
Glacier					
Softwood species	-	29	19,310	19,340	86.9
Hardwood species	-	9	2,917	2,926	13.1
Total all species	-	39	22,227	22,266	100.0
Pondera					
Softwood species	5,097	-	9,142	14,240	77.4
Hardwood species	105	-	4,059	4,164	22.6
Total all species	5,202	-	13,201	18,403	100.0

Table 75.

(Page 2)

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Teton					
Softwood species	2,352	2,244	31,520	36,116	79.5
Hardwood species	1,574	29	7,736	9,338	20.5
Total all species	3,925	2,273	39,256	45,454	100.0
Toole					
Softwood species	-	-	4,303	4,303	65.5
Hardwood species	-	-	2,263	2,263	34.5
Total all species	-	-	6,566	6,566	100.0
Working Circle Total					
Softwood species	26,762	2,273	400,451	429,487	89.8
Hardwood species	2,985	849	45,185	49,019	10.2
Total all species	29,747	3,123	445,636	478,506	100.0

Table 76. Net volume of sawtimber on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 7 (thousand board feet Scribner).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Blaine					
Softwood species	2,539	-	9,365	11,904	39.0
Hardwood species	2,068	-	16,520	18,588	61.0
Total all species	4,607	-	25,885	30,492	100.0
Daniels					
Softwood species	-	-	-	-	-
Hardwood species	-	-	-	-	-
Total all species	-	-	-	-	-
Garfield					
Softwood species	3,808	35,498	30,116	69,422	86.0
Hardwood species	264	3,942	7,079	11,284	14.0
Total all species	4,072	39,439	37,194	80,706	100.0
Hill					
Softwood species	1,013	-	6,510	7,522	48.6
Hardwood species	1,090	1,743	5,115	7,948	51.4
Total all species	2,103	1,743	11,625	15,470	100.0

Table 76.
 (Page 2)

County and Species	Ownership Group				Percentage of Total	
	DSL	Other		Total		
		Public	Private			
----- thousand board feet -----						
Liberty						
Softwood species	389	149	1,018	1,556	20.1	
Hardwood species	936	-	5,254	6,190	79.9	
Total all species	1,325	149	6,273	7,746	100.0	
McCone						
Softwood species	-	-	-	-	-	
Hardwood species	-	-	10,106	10,106	100.0	
Total all species	-	-	10,106	10,106	100.0	
Phillips						
Softwood species	2,263	2,901	5,607	10,770	40.0	
Hardwood species	1,018	1,291	13,826	16,135	60.0	
Total all species	3,281	4,191	19,432	26,905	100.0	
Richland						
Softwood species	-	-	51	51	0.1	
Hardwood species	-	2,724	36,324	39,048	99.9	
Total all species	-	2,724	36,375	39,099	100.0	
Roosevelt						
Softwood species	-	-	-	-	-	
Hardwood species	-	1,804	15,632	17,436	100.0	
Total all species	-	1,804	15,632	17,436	100.0	
Sheridan						
Softwood species	-	-	-	-	-	
Hardwood species	-	-	-	-	-	
Total all species	-	-	-	-	-	
Valley						
Softwood species	-	805	242	1,047	3.0	
Hardwood species	1,786	1,913	29,701	33,399	97.0	
Total all species	1,786	2,718	29,943	34,446	100.0	
Working Circle Total						
Softwood species	10,012	39,352	52,908	102,272	39.0	
Hardwood species	7,161	13,416	139,557	160,134	61.0	
Total all species	17,173	52,768	192,465	262,406	100.0	

Table 77. Net volume of sawtimber on commercial timberland by county, softwood and hardwood species, and ownership group, Working Circle 8 (thousand board feet Scribner).

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Big Horn					
Softwood species	3,609	1,882	76,243	81,733	74.6
Hardwood species	463	-	27,294	27,757	25.4
Total all species	4,072	1,882	103,537	109,491	100.0
Carter					
Softwood species	2,755	2,957	21,915	27,627	71.1
Hardwood species	-	445	10,757	11,203	28.9
Total all species	2,755	3,403	32,672	38,830	100.0
Custer					
Softwood species	4,486	9,659	39,847	53,991	65.3
Hardwood species	1,749	3,049	23,863	28,660	34.7
Total all species	6,234	12,708	63,709	82,651	100.0
Dawson					
Softwood species	-	964	1,468	2,432	13.1
Hardwood species	422	3,131	12,627	16,180	86.9
Total all species	422	4,095	14,095	18,611	100.0
Fallon					
Softwood species	-	123	710	834	16.2
Hardwood species	427	-	3,887	4,314	83.8
Total all species	427	123	4,598	5,147	100.0
Powder River					
Softwood species	7,751	18,666	51,765	78,181	64.0
Hardwood species	1,816	3,967	38,145	43,928	36.0
Total all species	9,567	22,633	89,909	122,109	100.0
Prairie					
Softwood species	248	1,025	483	1,756	50.3
Hardwood species	-	437	1,300	1,737	49.7
Total all species	248	1,462	1,783	3,493	100.0
Rosebud					
Softwood species	6,056	11,623	92,469	110,148	80.2
Hardwood species	2,163	702	24,381	27,246	19.8
Total all species	8,219	12,325	116,850	137,394	100.0
Sweet Grass					
Softwood species	9,419	15,054	200,655	225,128	90.3
Hardwood species	1,417	2,790	20,049	24,256	9.7
Total all species	10,835	17,845	220,704	249,384	100.0

Table 77.
(Page 2)

County and Species	Ownership Group				Percentage of Total
	DSL	Other Public	Private	Total	
Treasure					
Softwood species	2,430	1,364	27,608	31,402	63.5
Hardwood species	455	-	17,567	18,022	36.5
Total all species	2,884	1,364	45,176	49,424	100.0
Wibaux					
Softwood species	-	412	633	1,046	37.8
Hardwood species	445	407	871	1,724	62.2
Total all species	445	820	1,504	2,769	100.0
Yellowstone					
Softwood species	4,585	8,324	71,092	84,000	75.0
Hardwood species	911	7,375	19,674	27,959	25.0
Total all species	5,496	15,698	90,765	111,959	100.0
Working Circle Total					
Softwood species	41,338	72,052	584,887	698,277	75.0
Hardwood species	10,266	22,304	200,414	232,984	25.0
Total	51,605	94,356	785,301	931,261	100.0

APPENDIX 3. ADDITIONAL SURVEY INFORMATION

Table 78. Area of commercial timberland by ownership group, forest type, stand size class, and MAI site class, Working Circle 4 (thousand acres).

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)				All Classes
	85+	50-84	20-49	----- thousand acres-----	
Ponderosa pine					
Sawtimber	0.5	3.6	16.8		20.9
Poletimber	-	-	2.6		2.6
Seedlings and saplings	-	0.5	9.9		10.3
Nonstocked	-	-	-		-
Total	0.5	4.1	29.2		33.8
Douglas-fir					
Sawtimber	0.2	2.3	0.3		2.8
Poletimber	-	0.5	0.5		1.0
Seedlings and saplings	-	0.3	0.7		1.0
Nonstocked	-	-	-		-
Total	0.2	3.1	1.5		4.8
Lodgepole pine					
Sawtimber	-	-	-		-
Poletimber	-	-	0.3		0.3
Seedlings and saplings	0.3	-	-		0.3
Nonstocked	-	-	-		-
Total	0.3	-	0.3		0.5
Juniper					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-
Whitebark-limber pine					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-
Spruce					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-

Table 78.

(Page 2)

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
<hr/> <hr/> -----thousand acres-----				
Total softwoods				
Sawtimber	0.7	6.0	17.1	23.7
Poletimber	-	0.5	3.3	3.8
Seedlings and saplings	0.3	0.7	10.6	11.6
Nonstocked	-	-	-	-
Total	0.9	7.2	31.0	39.2
Cottonwood				
Sawtimber	-	-	0.2	0.2
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	0.2	0.2
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	0.3	0.4	0.7
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	0.3	0.4	0.7
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods				
Sawtimber	-	-	0.2	0.2
Poletimber	-	0.3	0.4	0.7
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	0.3	0.5	0.8
All Types				
Sawtimber	0.7	6.0	17.2	23.9
Poletimber	-	0.8	3.7	4.5
Seedlings and saplings	0.3	0.7	10.6	11.6
Nonstocked	-	-	-	-
Total	0.9	7.5	31.5	40.0

Table 78.

(Page 3)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Ponderosa pine				
Sawtimber	6.0	42.0	154.8	203.0
Poletimber	-	-	25.0	25.0
Seedlings and saplings	-	3.5	96.1	99.6
Nonstocked	-	-	-	-
Total	6.1	45.5	275.9	327.5
Douglas-fir				
Sawtimber	3.0	27.0	3.1	33.1
Poletimber	-	5.7	5.9	11.6
Seedlings and saplings	-	3.1	8.9	12.0
Nonstocked	-	-	-	-
Total	3.0	35.8	17.9	56.7
Lodgepole pine				
Sawtimber	-	-	-	-
Poletimber	-	-	2.9	2.9
Seedlings and saplings	2.9	-	-	2.9
Nonstocked	-	-	-	-
Total	2.9	-	2.9	5.7
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 78.

(Page 4)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Total softwoods				
Sawtimber	9.1	69.0	157.9	236.0
Poletimber	-	5.7	33.7	39.4
Seedlings and saplings	2.9	6.5	105.0	114.4
Nonstocked	-	-	-	-
Total	11.9	81.3	296.7	389.9
Cottonwood				
Sawtimber	-	-	3.6	3.6
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	3.6	3.6
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	6.4	6.2	12.6
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	6.4	6.2	12.6
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods				
Sawtimber	-	-	3.6	3.6
Poletimber	-	6.4	6.2	12.6
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	6.4	9.8	16.2
All Types				
Sawtimber	9.1	69.0	161.5	239.6
Poletimber	-	12.1	39.9	52.0
Seedlings and saplings	2.9	6.5	105.0	114.4
Nonstocked	-	-	-	-
Total	11.9	87.7	306.4	406.1

Table 78.

(Page 5)

Working Circle 4 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Ponderosa pine				
Sawtimber	6.6	45.7	171.6	223.9
Poletimber	-	-	27.6	27.6
Seedlings and saplings	-	3.9	106.0	109.6
Nonstocked	-	-	-	-
Total	6.6	49.6	305.2	361.3
Douglas-fir				
Sawtimber	3.2	29.3	3.4	35.9
Poletimber	-	6.2	6.3	12.6
Seedlings and saplings	-	3.4	9.7	13.0
Nonstocked	-	-	-	-
Total	3.2	38.9	19.4	61.5
Lodgepole pine				
Sawtimber	-	-	-	-
Poletimber	-	-	3.1	3.1
Seedlings and saplings	3.1	-	-	3.1
Nonstocked	-	-	-	-
Total	3.1	-	3.1	6.2
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 78.
(Page 6)

Working Circle 4 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Total softwoods				
Sawtimber	9.8	75.0	175.0	259.7
Poletimber	-	6.2	37.0	43.2
Seedlings and saplings	3.1	7.3	115.7	126.0
Nonstocked	-	-	-	-
Total	12.9	88.5	327.7	429.0
Cottonwood				
Sawtimber	-	-	3.7	3.7
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	3.7	3.7
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	6.7	6.6	13.3
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	6.7	6.6	13.3
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods				
Sawtimber	-	-	3.7	3.7
Poletimber	-	6.7	6.6	13.3
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	6.7	10.3	17.0
All Types				
Sawtimber	9.8	75.0	178.7	263.5
Poletimber	-	12.9	43.6	56.5
Seedlings and saplings	3.1	7.3	115.7	126.0
Nonstocked	-	-	-	-
Total	12.9	95.2	337.9	446.0

Table 79. Area of commercial timberland by ownership group, forest type, stand size class, and MAI site class, Working Circle 5 (thousand acres).

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			
	85+	50-84	20-49	All Classes
<hr/> <hr/> thousand acres <hr/>				
Ponderosa pine				
Sawtimber	-	0.9	2.4	3.4
Poletimber	-	-	0.2	0.2
Seedlings and saplings	-	-	0.1	0.1
Nonstocked	-	-	0.4	0.4
Total	-	0.9	3.2	4.1
Douglas-fir				
Sawtimber	-	0.1	0.5	0.7
Poletimber	-	0.2	0.2	0.3
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	0.3	0.7	1.0
Lodgepole pine				
Sawtimber	-	-	0.3	0.3
Poletimber	-	-	-	-
Seedlings and saplings	-	-	0.3	0.3
Nonstocked	-	-	-	-
Total	-	-	0.6	0.6
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	0.1	0.1
Nonstocked	-	-	0.1	0.1
Total	-	-	0.2	0.2
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	0.1	0.1
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.1	0.1
Total	-	-	0.1	0.1
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 79.

(Page 2)

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
Total softwoods	<hr/> -----thousand acres-----			
Sawtimber	-	1.1	3.2	4.3
Poletimber	-	0.2	0.5	0.6
Seedlings and saplings	-	-	0.5	0.5
Nonstocked	-	-	0.6	0.6
Total	-	1.3	4.8	6.1
Cottonwood				
Sawtimber	-	0.5	0.3	0.9
Poletimber	-	-	0.3	0.3
Seedlings and saplings	-	-	0.1	0.1
Nonstocked	-	-	-	-
Total	-	0.5	0.8	1.4
Aspen				
Sawtimber	-	0.1	-	0.1
Poletimber	-	-	0.4	0.4
Seedlings and saplings	-	-	0.5	0.5
Nonstocked	-	-	-	-
Total	-	0.1	0.9	1.0
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.1	0.1
Total	-	-	0.1	0.1
Total hardwoods				
Sawtimber	-	0.7	0.3	1.0
Poletimber	-	-	0.7	0.7
Seedlings and saplings	-	-	0.6	0.6
Nonstocked	-	-	0.1	0.1
Total	-	0.7	1.8	2.4
All Types				
Sawtimber	-	1.8	3.6	5.3
Poletimber	-	0.2	1.2	1.4
Seedlings and saplings	-	-	1.2	1.2
Nonstocked	-	-	0.7	0.7
Total	-	1.9	6.6	8.6

Table 79.
(Page 3)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
----- thousand acres -----				
Ponderosa pine				
Sawtimber	-	7.8	26.2	34.0
Poletimber	-	-	2.2	2.2
Seedlings and saplings	-	-	2.2	2.2
Nonstocked	-	-	3.4	3.4
Total	-	7.8	33.9	41.8
Douglas-fir				
Sawtimber	-	1.2	5.5	6.7
Poletimber	-	1.1	1.1	2.2
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	2.3	6.7	9.0
Lodgepole pine				
Sawtimber	-	-	1.5	1.5
Poletimber	-	-	-	-
Seedlings and saplings	-	-	2.2	2.2
Nonstocked	-	-	-	-
Total	-	-	3.7	3.7
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	1.1	1.1
Nonstocked	-	-	2.2	2.2
Total	-	-	3.2	3.2
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	1.1	1.1
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	1.1	1.1
Total	-	-	2.2	2.2
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 79.
(Page 4)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
Total softwoods	<hr/> -----thousand acres-----			
Sawtimber	-	9.0	33.2	42.2
Poletimber	-	1.1	4.4	5.5
Seedlings and saplings	-	-	5.5	5.5
Nonstocked	-	-	6.6	6.6
Total	-	10.1	49.7	59.8
Cottonwood	<hr/> -----thousand acres-----			
Sawtimber	-	4.6	2.6	7.3
Poletimber	-	-	2.6	2.6
Seedlings and saplings	-	-	1.2	1.2
Nonstocked	-	-	-	-
Total	-	4.6	6.4	11.1
Aspen	<hr/> -----thousand acres-----			
Sawtimber	-	0.3	-	0.3
Poletimber	-	-	1.8	1.8
Seedlings and saplings	-	-	2.5	2.5
Nonstocked	-	-	-	-
Total	-	0.3	4.3	4.6
Other hardwoods	<hr/> -----thousand acres-----			
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.8	0.8
Total	-	-	0.8	0.8
Total hardwoods	<hr/> -----thousand acres-----			
Sawtimber	-	5.0	2.6	7.6
Poletimber	-	-	4.4	4.4
Seedlings and saplings	-	-	3.7	3.7
Nonstocked	-	-	0.8	0.8
Total	-	5.0	11.5	16.5
All Types	<hr/> -----thousand acres-----			
Sawtimber	-	14.0	35.8	49.8
Poletimber	-	1.1	8.8	9.9
Seedlings and saplings	-	-	9.2	9.2
Nonstocked	-	-	7.4	7.4
Total	-	15.1	61.2	76.3

Table 79.
(Page 5)

Working Circle 5 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
<hr/> <hr/> <hr/> <hr/> <hr/>				
Ponderosa pine			-----thousand acres-----	
Sawtimber	-	8.8	28.6	37.4
Poletimber	-	-	2.4	2.4
Seedlings and saplings	-	-	2.3	2.3
Nonstocked	-	-	3.8	3.8
Total	-	8.8	37.1	45.9
Douglas-fir				
Sawtimber	-	1.3	6.1	7.4
Poletimber	-	1.3	1.3	2.6
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	2.6	7.3	10.0
Lodgepole pine				
Sawtimber	-	-	1.7	1.7
Poletimber	-	-	-	-
Seedlings and saplings	-	-	2.6	2.6
Nonstocked	-	-	-	-
Total	-	-	4.3	4.3
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	1.2	1.2
Nonstocked	-	-	2.3	2.3
Total	-	-	3.5	3.5
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 79.
(Page 6)

Working Circle 5 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
<hr/> <hr/> thousand acres <hr/> <hr/>				
Total softwoods				
Sawtimber	-	10.1	36.4	46.5
Poletimber	-	1.3	4.9	6.2
Seedlings and saplings	-	-	6.0	6.0
Nonstocked	-	-	7.2	7.2
Total	-	11.4	54.5	65.9
Cottonwood				
Sawtimber	-	5.2	3.0	8.1
Poletimber	-	-	3.0	3.0
Seedlings and saplings	-	-	1.3	1.3
Nonstocked	-	-	-	-
Total	-	5.2	7.3	12.4
Aspen				
Sawtimber	-	0.4	-	0.4
Poletimber	-	-	2.2	2.2
Seedlings and saplings	-	-	3.0	3.0
Nonstocked	-	-	-	-
Total	-	0.4	5.2	5.6
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.8	0.8
Total	-	-	0.8	0.8
Total hardwoods				
Sawtimber	-	5.6	3.0	8.6
Poletimber	-	-	5.1	5.1
Seedlings and saplings	-	-	4.3	4.3
Nonstocked	-	-	0.8	0.8
Total	-	5.6	13.3	18.9
All Types				
Sawtimber	-	15.7	39.4	55.1
Poletimber	-	1.3	10.0	11.3
Seedlings and saplings	-	-	10.4	10.4
Nonstocked	-	-	8.1	8.1
Total	-	17.0	67.8	84.8

Table 80. Area of commercial timberland by ownership group, forest type, stand size class, and MAI site class, Working Circle 6 (acres).

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)				All Classes
	85+	50-84	20-49		
-----thousand acres-----					
Ponderosa pine					
Sawtimber	-	0.2	2.5		2.7
Poletimber	-	-	-		-
Seedlings and saplings	-	-	0.2		0.2
Nonstocked	-	-	0.2		0.2
Total	-	0.2	2.8		3.0
Douglas-fir					
Sawtimber	-	1.5	1.1		2.6
Poletimber	-	-	0.7		0.7
Seedlings and saplings	-	-	1.1		1.1
Nonstocked	-	-	0.2		0.2
Total	-	1.5	3.0		4.5
Lodgepole pine					
Sawtimber	-	0.4	-		0.4
Poletimber	-	0.1	0.8		0.9
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	0.4	0.8		1.2
Juniper					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-
Whitebark-limber pine					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-
Spruce					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	-	-	-		-

Table 80.

(Page 2)

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Total softwoods				
Sawtimber	-	2.1	3.6	5.7
Poletimber	-	0.1	1.5	1.5
Seedlings and saplings	-	-	1.3	1.3
Nonstocked	-	-	0.3	0.3
Total	0.9	7.2	31.0	39.2
Cottonwood				
Sawtimber	-	-	0.4	0.4
Poletimber	-	-	-	-
Seedlings and saplings	-	-	0.2	0.2
Nonstocked	-	-	-	-
Total	-	-	0.7	0.7
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	0.1	0.1	0.2
Seedlings and saplings	-	-	0.2	0.2
Nonstocked	-	-	-	-
Total	-	0.1	0.3	0.4
Other hardwoods				
Sawtimber	-	0.1	-	0.1
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	0.1	-	0.1
Total hardwoods				
Sawtimber	-	0.1	0.4	0.6
Poletimber	-	0.1	0.1	0.2
Seedlings and saplings	-	-	0.4	0.4
Nonstocked	-	-	-	-
Total	-	0.2	1.0	1.2
All Types				
Sawtimber	-	2.2	4.0	6.2
Poletimber	-	0.2	1.6	1.8
Seedlings and saplings	-	-	1.7	1.7
Nonstocked	-	-	0.3	0.3
Total	-	2.4	7.6	10.0

Table 80.

(Page 3)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)				All Classes
	85+	50-84	20-49	thousand acres	
Ponderosa pine					
Sawtimber	-	2.8	30.8		33.7
Poletimber	-	-	-		-
Seedlings and saplings	-	-	2.6		2.6
Nonstocked	-	-	<u>1.1</u>		<u>1.1</u>
Total	<u>-</u>	<u>2.8</u>	<u>34.5</u>		<u>37.3</u>
Douglas-fir					
Sawtimber	-	20.9	15.0		35.9
Poletimber	-	-	7.7		7.7
Seedlings and saplings	-	-	13.9		13.9
Nonstocked	-	-	<u>2.6</u>		<u>2.6</u>
Total	<u>-</u>	<u>20.9</u>	<u>39.2</u>		<u>60.0</u>
Lodgepole pine					
Sawtimber	-	5.7	-		5.7
Poletimber	-	0.9	11.1		12.0
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	<u>-</u>	<u>6.6</u>	<u>11.1</u>		<u>17.7</u>
Juniper					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	<u>-</u>	<u>-</u>	<u>-</u>		<u>-</u>
Whitebark-limber pine					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	<u>-</u>	<u>-</u>	<u>-</u>		<u>-</u>
Spruce					
Sawtimber	-	-	-		-
Poletimber	-	-	-		-
Seedlings and saplings	-	-	-		-
Nonstocked	-	-	-		-
Total	<u>-</u>	<u>-</u>	<u>-</u>		<u>-</u>

Table 80.
(Page 4)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Total softwoods				
Sawtimber	-	29.4	45.9	75.3
Poletimber	-	0.9	18.8	19.7
Seedlings and saplings	-	-	16.5	16.5
Nonstocked	-	-	3.7	3.7
Total	-	30.3	84.7	115.0
Cottonwood				
Sawtimber	-	-	5.3	5.3
Poletimber	-	-	-	-
Seedlings and saplings	-	-	2.7	2.7
Nonstocked	-	-	-	-
Total	-	-	8.0	8.0
Aspen				
Sawtimber	-	-	-	1.6
Poletimber	-	1.3	1.3	1.6
Seedlings and saplings	-	-	2.8	2.8
Nonstocked	-	-	-	-
Total	-	1.3	4.1	5.4
Other hardwoods				
Sawtimber	-	1.3	-	1.3
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	1.3	-	1.3
Total hardwoods				
Sawtimber	-	1.3	5.3	6.7
Poletimber	-	1.3	1.3	2.6
Seedlings and saplings	-	-	5.5	5.5
Nonstocked	-	-	-	-
Total	-	2.6	12.1	14.8
All Types				
Sawtimber	-	30.7	51.2	81.9
Poletimber	-	2.2	20.1	22.3
Seedlings and saplings	-	-	22.0	22.0
Nonstocked	-	-	3.7	3.7
Total	-	32.9	96.8	129.8

Table 80.

(Page 5)

Working Circle 6 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Ponderosa pine				
Sawtimber	-	3.0	33.3	36.3
Poletimber	-	-	-	-
Seedlings and saplings	-	-	2.8	2.8
Nonstocked	-	-	1.2	1.2
Total	-	3.0	37.3	40.3
Douglas-fir				
Sawtimber	-	22.4	16.1	38.5
Poletimber	-	-	8.3	8.3
Seedlings and saplings	-	-	15.0	15.0
Nonstocked	-	-	2.8	2.8
Total	-	22.4	42.2	64.6
Lodgepole pine				
Sawtimber	-	6.1	-	6.1
Poletimber	-	0.9	11.9	12.8
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	7.0	11.9	18.9
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 80.
(Page 6)

Working Circle 6 Total

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
Total softwoods				
Sawtimber	-	31.5	49.4	80.9
Poletimber	-	1.0	20.2	21.2
Seedlings and saplings	-	-	17.7	17.7
Nonstocked	-	-	4.0	4.0
Total	-	32.5	91.3	123.8
Cottonwood				
Sawtimber	-	-	5.8	5.8
Poletimber	-	-	-	-
Seedlings and saplings	-	-	2.9	2.9
Nonstocked	-	-	-	-
Total	-	-	8.7	8.7
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	1.4	1.4	2.9
Seedlings and saplings	-	-	3.0	3.0
Nonstocked	-	-	-	-
Total	-	1.4	4.5	5.9
Other hardwoods				
Sawtimber	-	1.4	-	1.4
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	1.4	-	1.4
Total hardwoods				
Sawtimber	-	1.4	5.8	7.2
Poletimber	-	1.4	1.4	2.9
Seedlings and saplings	-	-	5.9	5.9
Nonstocked	-	-	-	-
Total	-	2.9	13.1	16.0
All Types				
Sawtimber	-	32.9	55.2	88.1
Poletimber	-	2.4	21.7	24.0
Seedlings and saplings	-	-	23.7	23.7
Nonstocked	-	-	4.0	4.0
Total	-	35.3	104.5	139.8

Table 81. Area of commercial timberland by ownership group, forest type, stand size class, and MAI Site Class, Working Circles 7 and 8 (thousand acres).

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)				All Classes
	85+	50-84	20-49	-----	
Ponderosa pine					
Sawtimber	-	5.7	37.4	-----	43.0
Poletimber	-	3.6	11.1	-----	14.7
Seedlings and saplings	-	-	19.1	-----	19.1
Nonstocked	-	-	-	-----	-
Total	-	9.3	67.5	-----	76.8
Douglas-fir					
Sawtimber	-	1.4	2.7	-----	4.1
Poletimber	-	-	-	-----	-
Seedlings and saplings	-	-	-	-----	-
Nonstocked	-	-	0.2	-----	0.2
Total	-	1.4	2.9	-----	4.3
Lodgepole pine					
Sawtimber	-	-	-	-----	-
Poletimber	-	-	1.5	-----	1.5
Seedlings and saplings	-	-	0.2	-----	0.2
Nonstocked	-	-	-	-----	-
Total	0.3	-	1.8	-----	1.8
Juniper					
Sawtimber	-	-	-	-----	-
Poletimber	-	-	-	-----	-
Seedlings and saplings	-	-	-	-----	-
Nonstocked	-	-	-	-----	-
Total	-	-	-	-----	-
Whitebark-limber pine					
Sawtimber	-	-	-	-----	-
Poletimber	-	-	-	-----	-
Seedlings and saplings	-	-	-	-----	-
Nonstocked	-	-	-	-----	-
Total	-	-	-	-----	-
Spruce					
Sawtimber	-	-	-	-----	-
Poletimber	-	-	-	-----	-
Seedlings and saplings	-	-	-	-----	-
Nonstocked	-	-	-	-----	-
Total	-	-	-	-----	-

Table 81.
(Page 2)

State and Other Public

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
Total softwoods				
Sawtimber	-	7.1	40.1	47.1
Poletimber	-	3.6	12.6	16.2
Seedlings and saplings	-	-	19.4	19.4
Nonstocked	-	-	0.2	0.2
Total	-	10.7	72.2	82.9
Cottonwood				
Sawtimber	-	2.3	9.2	11.4
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	2.3	9.2	11.4
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	2.4	-	2.4
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	2.4	-	2.4
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods				
Sawtimber	-	2.3	9.2	11.4
Poletimber	-	2.4	-	2.4
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	4.6	9.2	13.8
All Types				
Sawtimber	-	9.3	49.2	58.6
Poletimber	-	6.0	12.6	18.6
Seedlings and saplings	-	-	19.4	19.4
Nonstocked	-	-	0.2	0.2
Total	-	15.3	81.4	96.7

Table 81.

(Page 3)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Ponderosa pine				
Sawtimber	-	16.6	137.9	154.5
Poletimber	-	3.7	33.6	37.2
Seedlings and saplings	-	-	89.7	89.7
Nonstocked	-	-	-	-
Total	-	20.3	261.1	281.4
Douglas-fir				
Sawtimber	-	9.4	12.8	22.3
Poletimber	-	-	0.8	0.8
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.5	0.5
Total	-	9.4	14.1	23.6
Lodgepole pine				
Sawtimber	-	-	-	-
Poletimber	-	-	4.2	4.2
Seedlings and saplings	-	-	1.9	1.9
Nonstocked	-	-	-	-
Total	-	-	6.1	6.1
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Whitebark-limber pine				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	0.8	-	0.8
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	0.8	-	0.8

Table 81.
(Page 4)

Private

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
	-----thousand acres-----			
Total softwoods				
Sawtimber	-	26.9	150.7	177.6
Poletimber	-	3.7	38.6	42.2
Seedlings and saplings	-	-	91.6	91.6
Nonstocked	-	-	0.5	0.5
Total	-	30.5	281.4	311.9
Cottonwood				
Sawtimber	-	15.8	63.1	78.9
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	15.8	63.1	78.9
Aspen				
Sawtimber	-	-	-	-
Poletimber	-	2.5	-	2.5
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	2.5	-	2.5
Other hardwoods				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods				
Sawtimber	-	15.8	63.1	78.9
Poletimber	-	2.5	-	2.5
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	18.3	63.1	81.4
All Types				
Sawtimber	-	42.6	213.8	256.5
Poletimber	-	6.2	38.6	44.8
Seedlings and saplings	-	-	91.6	91.6
Nonstocked	-	-	0.5	0.5
Total	-	48.8	344.5	393.3

Table 81.

(Page 5)

Working Circles 7 and 8

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
-----thousand acres-----				
Ponderosa pine				
Sawtimber	-	22.3	175.2	197.5
Poletimber	-	7.3	44.6	51.9
Seedlings and saplings	-	-	108.8	108.8
Nonstocked	-	-	-	-
Total	-	29.6	328.7	358.2
Douglas-fir				
Sawtimber	-	10.8	15.6	26.4
Poletimber	-	-	0.8	0.8
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	0.6	0.6
Total	-	10.8	17.0	27.8
Lodgepole pine				
Sawtimber	-	-	-	-
Poletimber	-	-	5.7	5.7
Seedlings and saplings	-	-	2.1	2.1
Nonstocked	-	-	-	-
Total	-	-	7.9	7.9
Juniper				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Whitebark-limber pine	-			
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Spruce				
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-

Table 81.

(Page 6)

Working Circles 7 and 8

Forest Type and Stand Size Class	Site Class (cubic feet/acre/year)			All Classes
	85+	50-84	20-49	
Total softwoods	<hr/> -----thousand acres-----			
Sawtimber	-	33.9	190.8	224.7
Poletimber	-	7.3	51.2	58.4
Seedlings and saplings	-	-	111.0	111.0
Nonstocked	-	-	0.6	0.6
Total	-	41.2	353.6	394.7
Cottonwood	<hr/>			
Sawtimber	-	18.1	72.3	90.3
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	18.1	72.3	90.3
Aspen	<hr/>			
Sawtimber	-	-	-	-
Poletimber	-	4.9	-	4.9
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	4.9	-	4.9
Other hardwoods	<hr/>			
Sawtimber	-	-	-	-
Poletimber	-	-	-	-
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	-	-	-
Total hardwoods	<hr/>			
Sawtimber	-	18.1	72.3	90.3
Poletimber	-	4.9	-	4.9
Seedlings and saplings	-	-	-	-
Nonstocked	-	-	-	-
Total	-	23.0	72.3	95.2
All Types	<hr/>			
Sawtimber	-	52.0	263.1	315.1
Poletimber	-	12.2	51.2	63.3
Seedlings and saplings	-	-	111.0	111.0
Nonstocked	-	-	0.6	0.6
Total	-	64.1	425.8	490.0

Table 82. Area of commercial timberland by stand volume class and ownership group, Working Circle 4 (thousand acres).

Cubic Foot Volume Class	Ownership Group					
	State and Other Public		Private		Total	
	-----thousand acres-----					
	%	%	%	%	%	%
Less than 500	11.5	28.7	111.8	27.5	123.3	26.7
500 - 1,499	20.2	50.5	194.9	48.0	215.1	48.2
1,500 - 2,499	5.7	14.2	69.7	17.2	75.4	16.9
2,500 - 3,499	2.1	5.3	23.9	5.9	26.0	5.8
3,500 - 4,999	0.5	1.3	5.9	1.4	6.3	1.4
5,000 or more	-	-	-	-	-	-
Total all classes	40.0	100.0	406.1	100.0	446.0	100.0

Table 83. Area of commercial timberland by stand volume class and ownership group, Working Circle 5 (thousand acres).

Cubic Foot Volume Class	Ownership Group					
	State and Other Public		Private		Total	
	-----thousand acres-----					
	%	%	%	%	%	%
Less than 500	3.0	35.7	32.8	43.0	35.9	42.3
500 - 1,499	4.4	52.4	33.0	43.3	37.4	44.1
1,500 - 2,499	0.7	8.3	8.2	10.8	8.9	10.5
2,500 - 3,499	0.3	3.6	2.2	2.9	2.6	3.1
3,500 - 4,999	-	-	-	-	-	-
5,000 or more	-	-	-	-	-	-
Total all classes	8.5	100.0	76.3	100.0	84.8	100.0

Table 84. Area of commercial timberland by stand volume class and ownership group, Working Circle 6 (thousand acres).

Cubic Foot Volume Class	Ownership Group					
	State and Other Public		Private		Total	
	-----thousand acres-----					
	%	%	%	%	%	%
Less than 500	3.8	38.0	48.2	37.1	52.1	37.3
500 - 1,499	3.3	33.0	41.5	32.0	44.7	32.0
1,500 - 2,499	2.0	20.0	27.4	21.1	29.4	21.0
2,500 - 3,499	0.3	3.0	4.2	3.2	4.5	3.2
3,500 - 4,999	0.6	6.0	8.5	6.6	9.1	6.5
5,000 or more	-	-	-	-	-	-
Total all classes	10.0	100.0	129.8	100.0	139.8	100.0

Table 85. Area of commercial timberland by stand volume class and ownership group, Working Circles 7 and 8 (thousand acres).

Cubic Foot Volume Class	Ownership Group					
	State and Other Public		Private		Total	
	-----thousand acres-----					
	%	%	%	%	%	%
Less than 500	26.7	27.7	117.3	29.8	144.0	29.4
500 - 1,499	61.7	63.8	236.0	60.0	297.6	60.7
1,500 - 2,499	8.0	8.3	36.5	9.3	44.6	9.1
2,500 - 3,499	-	-	-	-	-	-
3,500 - 4,999	0.2	0.2	3.5	0.9	3.8	0.8
5,000 or more	-	-	-	-	-	-
Total all classes	96.7	100.0	393.3	100.0	490.0	100.0

Table 86. Net volume of growing stock on private commercial timberland by diameter class and species, Working Circle 4 (thousand cubic feet).

Diameter Class	Softwood Species					
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark limber pine	Spruce	Subalpine fir
	-----thousand cubic feet-----					
5.0 - 6.9	22,821	7,079	5,687	1,328	875	238
7.0 - 8.9	47,465	10,794	5,153	175	1,222	-
9.0 - 10.9	69,055	14,773	3,467	-	1,081	-
11.0 - 12.9	67,252	10,448	2,288	-	1,345	-
13.0 - 14.9	48,009	9,443	-	-	1,158	-
15.0 - 16.9	29,924	6,815	-	-	299	-
17.0 - 18.9	23,727	2,740	-	-	706	-
19.0 - 20.9	11,367	1,886	-	-	298	-
21.0 - 22.9	4,720	1,410	-	-	-	-
23.0 - 24.9	766	1,134	-	-	-	-
25.0 - 26.9	960	433	-	-	340	-
27.0 - 28.9	787	679	-	-	-	-
29.0+	384	567	-	-	-	238
All Classes	327,237	68,202	16,595	1,503	7,324	238
Hardwood Species						
Diameter Class	Total Softwood Species	Cottonwood	Aspen	Other hardwoods	Total Hardwood Species	Total All Species
	-----thousand cubic feet-----					
	38,029	-	7,692	-	7,692	45,721
5.0 - 6.9	64,809	-	8,824	-	8,824	73,633
7.0 - 8.9	88,375	-	2,611	-	2,611	90,986
9.0 - 10.9	81,334	354	249	-	603	81,936
11.0 - 12.9	58,611	440	-	-	440	59,051
13.0 - 14.9	37,038	678	-	-	678	37,716
15.0 - 16.9	27,173	1,152	-	-	1,152	28,325
17.0 - 18.9	13,552	228	-	-	228	13,780
19.0 - 20.9	6,129	253	-	-	253	6,382
21.0 - 22.9	1,900	741	-	-	741	2,642
23.0 - 24.9	1,732	414	-	-	414	2,146
25.0 - 26.9	1,466	-	-	-	-	1,466
27.0 - 28.9	951	173	-	-	173	1,124
All Classes	421,099	4,433	19,375	-	23,808	444,908

Table 87. Net volume of growing stock on private commercial timberland by diameter class and species, Working Circle 6 (thousand cubic feet).

Diameter Class	Softwood Species						Subalpine fir
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark-limber pine	Spruce		
	-----thousand cubic feet-----						
5.0 - 6.9	907	6,750	9,702	779	-	-	
7.0 - 8.9	1,798	6,781	8,407	855	132	-	
9.0 - 10.9	2,381	11,847	8,101	1,631	459	124	
11.0 - 12.9	3,740	11,347	6,003	1,156	100	-	
13.0 - 14.9	4,076	9,529	2,664	136	-	-	
15.0 - 16.9	5,239	6,378	3,003	-	-	-	
17.0 - 18.9	4,758	4,376	1,205	-	-	-	
19.0 - 20.9	2,694	3,167	670	-	-	-	
21.0 - 22.9	1,480	1,180	-	-	-	-	
23.0 - 24.9	466	1,314	-	-	-	-	
25.0 - 26.9	1,503	659	267	-	-	-	
27.0 - 28.9	-	-	-	-	-	-	
29.0+	<u>736</u>	<u>1,435</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	
All Classes	29,779	64,764	40,022	4,557	691	124	
Hardwood Species							
Diameter Class	Total Softwood Species	Other			Total Hardwood Species	Total All Species	
		Cottonwood	Aspen	hardwoods			
	-----thousand cubic feet-----						
5.0 - 6.9	18,138	435	1,198	-	1,633	19,771	
7.0 - 8.9	17,973	352	608	446	1,407	19,380	
9.0 - 10.9	24,542	462	404	305	1,171	25,713	
11.0 - 12.9	22,346	274	-	165	439	22,785	
13.0 - 14.9	16,405	871	-	256	1,127	17,532	
15.0 - 16.9	14,620	814	-	397	1,211	15,831	
17.0 - 18.9	10,340	1,151	-	265	1,416	11,756	
19.0 - 20.9	6,531	1,450	-	93	1,543	8,074	
21.0 - 22.9	2,660	1,808	-	-	1,808	4,469	
23.0 - 24.9	1,781	1,416	-	-	1,416	3,196	
25.0 - 26.9	2,428	934	-	-	934	3,362	
27.0 - 28.9	-	572	-	-	572	572	
29.0+	<u>2,171</u>	<u>597</u>	<u>-</u>	<u>-</u>	<u>597</u>	<u>2,768</u>	
All Classes	139,936	11,134	2,210	1,928	15,272	155,208	

Table 88. Net volume of growing stock on private commercial timberland by diameter class and species, Working Circles 5, 7, and 8 (thousand cubic feet).

Diameter Class	Softwood Species						Subalpine* fir
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark limber pine	Spruce		
	-----thousand cubic feet-----						
5.0 - 6.9	16,526	5,648	6,330	1,209	181	57	
7.0 - 8.9	24,624	8,263	4,481	1,520	669	231	
9.0 - 10.9	34,128	7,830	2,872	1,494	842	114	
11.0 - 12.9	38,317	9,036	1,028	412	604	-	
13.0 - 14.9	36,775	7,404	844	204	154	53	
15.0 - 16.9	25,979	6,299	239	60	85	50	
17.0 - 18.9	16,961	3,699	172	212	-	-	
19.0 - 20.9	6,333	1,443	-	-	-	-	
21.0 - 22.9	5,618	1,182	-	-	93	-	
23.0 - 24.9	2,661	422	-	-	-	-	
25.0 - 26.9	2,591	377	-	-	-	-	
27.0 - 28.9	1,107	287	-	-	100	-	
29.0+	<u>1,007</u>	<u>1,471</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
All Classes	212,626	53,360	15,966	5,111	2,728	506	
Hardwood Species							
Diameter Class	Total Softwood	Species	Cottonwood	Aspen	Other hardwoods	Total Hardwood	Total All Species
	Species					Species	Species
	-----thousand cubic feet-----						
5.0 - 6.9	29,952	1,874	1,539	-	-	3,414	33,365
7.0 - 8.9	39,787	891	2,008	-	-	2,899	42,686
9.0 - 10.9	47,281	3,885	2,963	-	-	6,848	54,128
11.0 - 12.9	49,397	5,874	1,229	-	-	7,103	56,500
13.0 - 14.9	45,433	11,410	574	-	-	11,985	57,418
15.0 - 16.9	32,712	12,520	-	-	-	12,520	45,232
17.0 - 18.9	21,044	9,598	-	-	-	9,598	30,641
19.0 - 20.9	7,775	12,721	-	-	-	12,721	20,497
21.0 - 22.9	6,893	13,021	-	-	-	13,021	19,914
23.0 - 24.9	3,083	5,565	-	-	-	5,565	8,648
25.0 - 26.9	2,968	4,137	-	-	-	4,137	7,105
27.0 - 28.9	1,495	6,624	-	-	-	6,624	8,120
29.0+	<u>2,478</u>	<u>11,592</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>11,592</u>	<u>14,070</u>
All Classes	290,296	99,713	8,314	-	-	108,027	398,324

*Subalpine fir was only sampled in Working Circle 8.

Table 89. Net volume of sawtimber on private commercial timberland by diameter class and species, Working Circle 4 (thousand board feet Scribner).

Diameter Class	Softwood Species					
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark limber pine	Spruce	Subalpine fir
	----- thousand board feet -----					
9.0 - 10.9	138,231	41,127	12,255	-	3,817	-
11.0 - 12.9	201,521	38,859	10,739	-	6,193	-
13.0 - 14.9	170,496	38,638	-	-	5,252	-
15.0 - 16.9	114,811	28,989	-	-	1,337	-
17.0 - 18.9	94,551	11,939	-	-	3,125	-
19.0 - 20.9	46,319	8,394	-	-	1,311	-
21.0 - 22.9	18,728	6,368	-	-	-	-
23.0 - 24.9	3,164	5,143	-	-	-	-
25.0 - 26.9	3,652	1,940	-	-	1,599	-
27.0 - 28.9	3,114	3,154	-	-	-	-
29.0+	<u>1,344</u>	<u>2,619</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
All Classes	795,931	187,170	22,994	-	22,634	-

Diameter Class	Hardwood Species					
	Total Softwood	Species	Cottonwood	Aspen	Other hardwoods	Total Hardwood
	Species					
	Total					
----- thousand cubic feet -----						
9.0 - 10.9	195,430	-	-	-	-	195,430
11.0 - 12.9	257,312	1,520	1,005	-	2,525	259,837
13.0 - 14.9	214,386	1,904	-	-	1,904	216,290
15.0 - 16.9	145,137	2,842	-	-	2,842	147,979
17.0 - 18.9	109,615	4,791	-	-	4,791	114,406
19.0 - 20.9	56,024	923	-	-	923	56,947
21.0 - 22.9	25,096	995	-	-	995	26,091
23.0 - 24.9	8,307	2,868	-	-	2,868	11,175
25.0 - 26.9	7,191	1,586	-	-	1,586	8,777
27.0 - 28.9	6,268	-	-	-	-	6,268
29.0+	<u>3,963</u>	<u>684</u>	<u>-</u>	<u>-</u>	<u>684</u>	<u>4,647</u>
All Classes	1,028,728	18,113	1,005	-	19,118	1,047,846

Table 90. Net volume of sawtimber on private commercial timberland by diameter class and species, Working Circle 6 (thousand board feet Scribner).

Diameter Class	Softwood Species					
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark limber pine	Spruce	Subalpine fir
	-----thousand board feet-----					
9.0 - 10.9	4,224	33,167	25,616	4,704	1,471	241
11.0 - 12.9	11,851	41,605	29,671	4,899	430	-
13.0 - 14.9	15,715	37,739	13,006	574	-	-
15.0 - 16.9	21,204	26,965	14,367	-	-	-
17.0 - 18.9	20,125	19,077	5,627	-	-	-
19.0 - 20.9	11,317	13,992	3,110	-	-	-
21.0 - 22.9	6,441	5,282	-	-	-	-
23.0 - 24.9	1,986	5,906	-	-	-	-
25.0 - 26.9	6,298	2,971	1,268	-	-	-
27.0 - 28.9	-	-	-	-	-	-
29.0+	<u>2,935</u>	<u>6,664</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
All Classes	102,096	193,368	92,665	10,177	1,901	244
Hardwood Species						
Diameter Class	Total Softwood Species	Cottonwood	Aspen	Other hardwoods	Total Hardwood Species	Total All Species
	-----thousand cubic feet-----					
	69,426	-	-	-	-	69,426
9.0 - 10.9	88,456	1,188	-	700	1,888	90,344
11.0 - 12.9	67,034	3,828	-	1,096	4,924	71,958
13.0 - 14.9	62,536	3,483	-	1,695	5,178	67,714
15.0 - 16.9	44,829	4,818	-	1,093	5,911	50,740
17.0 - 18.9	28,419	5,879	-	377	6,256	34,675
19.0 - 20.9	11,723	7,171	-	-	7,171	18,894
21.0 - 22.9	7,892	5,565	-	-	5,565	13,457
23.0 - 24.9	10,537	3,640	-	-	3,640	14,177
25.0 - 26.9	-	2,282	-	-	2,282	2,282
27.0 - 28.9	<u>9,599</u>	<u>2,370</u>	<u>-</u>	<u>-</u>	<u>2,370</u>	<u>11,969</u>
All Classes	400,451	40,224	-	4,961	45,185	445,636

Table 91. Net volume of sawtimber on private commercial timberland by diameter class and species, Working Circles 5, 7, and 8 (thousand board feet Scribner).

Diameter Class	Softwood Species						Subalpine fir
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark limber pine	Spruce		
	thousand board feet						
9.0 - 10.9	60,002	16,832	10,456	4,716	3,020	297	
11.0 - 12.9	109,018	30,469	4,772	1,776	2,605	-	
13.0 - 14.9	132,670	29,283	3,960	933	691	222	
15.0 - 16.9	107,331	27,713	1,116	272	386	216	
17.0 - 18.9	74,833	17,092	820	981	-	-	
19.0 - 20.9	28,966	6,783	-	-	-	-	
21.0 - 22.9	25,884	5,869	-	-	434	-	
23.0 - 24.9	12,415	2,082	-	-	-	-	
25.0 - 26.9	11,537	1,886	-	-	-	-	
27.0 - 28.9	4,981	1,428	-	-	494	-	
29.0+	<u>4,548</u>	<u>7,622</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>
All Classes	572,186	147,059	21,124	8,678	7,631	734	
Hardwood Species							
Diameter Class	Total Softwood Species	Cottonwood	Aspen	Other hardwoods	Total Hardwood Species	Total All Species	
		thousand cubic feet					
9.0 - 10.9	95,323	-	-	-	-	95,323	
11.0 - 12.9	148,641	23,898	5,015	-	28,913	177,554	
13.0 - 14.9	167,759	47,868	2,451	-	50,320	218,079	
15.0 - 16.9	137,034	53,136	-	-	53,136	190,171	
17.0 - 18.9	93,726	39,955	-	-	39,955	133,682	
19.0 - 20.9	35,749	51,873	-	-	51,873	87,622	
21.0 - 22.9	32,187	52,324	-	-	52,324	84,511	
23.0 - 24.9	14,496	22,271	-	-	22,271	36,768	
25.0 - 26.9	13,423	16,495	-	-	16,495	29,917	
27.0 - 28.9	6,902	26,624	-	-	26,624	33,526	
29.0+	<u>12,170</u>	<u>47,327</u>	<u>-</u>	<u>-</u>	<u>47,327</u>	<u>59,497</u>	<u>-</u>
All Classes	757,412	381,772	7,466	-	389,239	1,146,650	

Table 92. Volume of timber on commercial timberland by class of timber,
Working Circle 4 (thousand cubic feet).

Class of Timber	Volume (MFT ³)
Live Trees	
Growing Stock	
Sawtimber	
Sawlog	295,530
Upper stem	57,660
Total	353,190
Poletimber	132,836
All Growing Stock	486,026
Sound Cull	
Sawtimber	5,605
Poletimber	5,700
Total	11,305
Rotten Cull	
Sawtimber	687
Poletimber	278
Total	965
Salvable Dead	
Sawtimber	11,815
Poletimber	8,270
Total	20,085
Total All Timber	518,381

Table 93. Volume of timber on commercial timberland by class of timber,
Working Circle 5 (thousand cubic feet).

Class of Timber	Volume (MFt ³)
Live Trees	
Growing Stock	
Sawtimber	
Sawlog	42,909
Upper stem	8,369
Total	51,278
Poletimber	21,150
All Growing Stock	72,428
Sound Cull	
Sawtimber	559
Poletimber	506
Total	1,065
Rotten Cull	
Sawtimber	60
Poletimber	-
Total	60
Salvable Dead	
Sawtimber	1,828
Poletimber	937
Total	2,765
Total All Timber	76,318

Table 94. Volume of timber on commercial timberland by class of timber,
Working Circle 6 (thousand cubic feet).

Class of Timber	Volume (Mft ³)
Live Trees	
Growing Stock	
Sawtimber	
Sawlog	107,752
Upper stem	15,615
Total	123,367
Poletimber	43,311
All Growing Stock	166,678
Sound Cull	
Sawtimber	348
Poletimber	469
Total	817
Rotten Cull	
Sawtimber	108
Poletimber	105
Total	213
Salvable Dead	
Sawtimber	4,212
Poletimber	2,863
Total	7,075
Total All Timber	174,782

Table 95. Volume of timber on commercial timberland by class of timber,
Working Circles 7 and 8 (thousand cubic feet).

Class of Timber	Volume (MFT ³)
Live Trees	
Growing Stock	
Sawtimber	
Sawlog	276,328
Upper stem	53,519
Total	329,846
Poletimber	83,541
All Growing Stock	413,387
Sound Cull	
Sawtimber	2,983
Poletimber	4,654
Total	7,637
Rotten Cull	
Sawtimber	1,128
Poletimber	321
Total	1,449
Salvable Dead	
Sawtimber	8,571
Poletimber	4,541
Total	13,113
Total All Timber	435,586

Table 96. Ratio of net board foot Scribner to net cubic foot volume by diameter class and softwood species on commercial timberland, Working Circle 4.

Diameter Class	Species					Total Softwood Species
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark-limber pine	Spruce	
9.0 - 10.9	1.8	2.5	3.6	-	3.4	2.0
11.0 - 12.9	2.9	3.6	4.7	-	4.5	3.0
13.0 - 14.9	3.6	4.2	-	-	4.5	3.7
15.0 - 16.9	4.0	4.5	-	-	4.5	4.1
17.0 - 18.9	4.3	4.7	-	-	4.6	4.4
19.0 - 20.9	4.5	4.8	-	-	4.6	4.6
21.0 - 22.9	4.5	5.0	-	-	-	4.6
23.0 - 24.9	4.7	5.1	-	-	-	4.9
25.0 - 26.9	4.4	5.0	-	-	5.0	4.7
27.0 - 28.9	4.6	5.2	-	-	-	4.9
29.0+	4.2	5.2	-	-	-	4.7
Total sawtimber (all trees 9.0"+ d.b.h.)	3.1	3.7	4.0	-	4.3	3.2
Total growing stock (all trees 5.0"+ d.b.h.)	2.4	2.7	1.4	-	3.1	2.4

Table 97. Ratio of net board foot Scribner to net cubic foot volume by diameter class and softwood species on commercial timberland, Working Circle 5.

Diameter Class	Species					Total Softwood Species
	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark-limber pine	Spruce	
9.0 - 10.9	1.7	2.3	3.7	3.1	-	2.0
11.0 - 12.9	2.9	3.3	4.6	4.3	-	3.2
13.0 - 14.9	3.6	3.9	4.6	4.6	-	3.8
15.0 - 16.9	4.1	4.4	4.7	4.5	-	4.2
17.0 - 18.9	4.5	4.6	-	4.6	-	4.5
19.0 - 20.9	4.5	4.6	-	-	-	4.6
21.0 - 22.9	4.6	4.9	-	-	-	4.7
23.0 - 24.9	4.7	4.9	-	-	-	4.8
25.0 - 26.9	4.7	5.0	-	-	-	4.8
27.0 - 28.9	4.8	5.0	-	-	-	4.9
29.0+	4.4	5.2	-	-	-	4.6
Total sawtimber (all trees 9.0"+ d.b.h.)	3.4	3.5	4.1	4.5	-	3.5
Total growing stock (all trees 5.0"+ d.b.h)		2.8	2.0	2.3	2.9	2.5
				3.7	-	

Table 98. Ratio of net board feet Scribner to net cubic foot volume by diameter class and softwood species on commercial timberland, Working Circle 6.

Diameter Class	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark-limber pine	Spruce	Species		Total Softwood Species
						Subalpine fir		
9.0 - 10.9	1.5	2.4	3.2	3.0	3.2		2.0	2.6
11.0 - 12.9	2.9	3.5	4.8	4.0	4.3		-	3.8
13.0 - 14.9	3.7	4.0	4.9	4.2	4.1		-	4.1
15.0 - 16.9	4.0	4.4	4.9	4.2	4.4		-	4.4
17.0 - 18.9	4.3	4.7	4.8	4.2	4.5		-	4.5
19.0 - 20.9	4.4	4.8	4.8	4.2	4.6		-	4.6
21.0 - 22.9	4.6	5.0	5.0	4.8	4.8		-	4.8
23.0 - 24.9	4.6	5.0	5.0	4.8	4.9		-	4.9
25.0 - 26.9	4.6	5.0	5.0	4.8	4.8		-	4.8
27.0 - 28.9	-	-	-	-	-		-	-
29.0+	4.5	5.2						4.9
Total sawtimber (all trees 9.0"+ d.b.h.)	3.8	4.2	3.5	3.4	3.5		2.0	3.9
Total growing stock (all trees 5.0"+ d.b.h.)	3.4	3.0	2.3	2.2	2.7		2.0	2.9

Table 99. Ratio of net board foot Scribner to net cubic foot volume by diameter class and softwood species on commercial timberland, Working Circles 7 and 8.

Diameter Class	Ponderosa pine	Douglas-fir	Lodgepole pine	Whitebark-limber pine	Spruce	Species	
						Total Softwood Species	Subalpine fir
9.0 - 10.9	1.8	2.1	3.6	3.2	3.6	2.6	2.0
11.0 - 12.9	2.8	3.4	4.7	4.3	-	-	3.0
13.0 - 14.9	3.6	4.0	4.7	-	-	4.2	3.7
15.0 - 16.9	4.1	4.4	4.7	-	4.6	4.3	4.2
17.0 - 18.9	4.4	4.6	4.8	-	-	-	4.4
19.0 - 20.9	4.6	4.7	-	-	-	-	4.6
21.0 - 22.9	4.6	5.0	-	-	4.7	-	4.6
23.0 - 24.9	4.7	4.9	-	-	-	-	4.7
25.0 - 26.9	4.4	5.0	-	-	-	-	4.4
27.0 - 28.9	4.4	5.0	-	-	-	-	4.5
29.0+	4.6	5.2	-	-	-	-	5.0
Total sawtimber (all trees 9.0"+ d.b.h.)	3.3	3.8	3.9	3.3	4.0	3.4	
Total growing stock (all trees 5.0"+ d.b.h.)					1.2	2.7	1.5
							2.6

APPENDIX 4. WOOD PROCESSORS IN EASTERN MONTANA

Table 100. Sawmills in Working Circles 4, 5, 6, 7, and 8.

<u>COMPANY</u>	<u>ANNUAL PRODUCTION</u>	<u>SPECIES PROCESSED</u>	<u>PRODUCTS MANUFACTURED</u>
BIG HORN COUNTY			
<u>Hardin</u> Wilson J. Hammond	Less than 3 MMBF	PP	Dimension 1" Boards Ties Timbers Rough
CARTER COUNTY			
<u>Ekalaka</u> Silas Knapp	Less than 3 MMBF		Part Time Sawmill
CHOUTEAU COUNTY			
<u>Highwood</u> Kind Sawmill	Less than 3 MMBF		
CUSTER COUNTY			
<u>Volberg</u> Wheatwell Lumber	Less than 3 MMBF	PP	Ties Dimension 1" boards Timbers Rough
FERGUS COUNTY			
<u>Garneill</u> Ray Luther Sawmill	Less than 3 MMBF	DF PP	1" boards Ties, Rough
<u>Lewistown</u> Berg Lumber Co.	3 - 5 MMBF		Ties 1" boards
Big Sky Lumber	Less than 3 MMBF		
Britton Lumber Co.	Less than 3 MMBF	DF PP	Ties Rough
Hall Sawmill	Less than 3 MMBF	PP DF	1" boards Ties Rough
Lemmon Sawmill			
<u>Moore</u> Edwards Sawmill			

*Information obtained from the 1983 Directory of Montana's Forest Products Industry, Montana Department of State Lands, Forestry Division.

Table 100.

(Page 2)

<u>COMPANY</u>	<u>ANNUAL PRODUCTION</u>	<u>SPECIES PROCESSED</u>	<u>PRODUCTS MANUFACTURED</u>
JUDITH BASIN COUNTY			
<u>Judith Basin</u>			
Judith River Sawmills Inc.			
MUSSELSHELL COUNTY			
<u>Roundup</u>			
Gebhardt Post & Lumber	Less than 3 MMBF	PP	1" boards Rough
Rath's Sawmill	Less than 3 MMBF	PP	1" boards Rough Part Time Sawmill
Sealy Sawmill	3 - 5 MMBF	DF PP	Dimension 1" Boards Timbers Studs, Ties
Yount Sawmill	Less than 3 MMBF	PP	1" Boards Rough
ROSEBUD COUNTY			
<u>Lame Deer</u>			
Black Lumber Co.	Less than 3 MMBF	PP	Dimension Timbers Ties, Studs Rough Surfaced
STILLWATER COUNTY			
<u>Reedpoint</u>			
B&J Sawmill	3 - 5 MMBF	PP DF	1" boards Rough
SWEET GRASS COUNTY			
<u>Big Timber</u>			
Ralph Cosgriff	Less than 3 MMBF	PP	1" boards Rough Part Time Sawmill
Timberline Sawmill	Less than 3 MMBF	PP DF	Dimension 1" boards Ties, Rough Timbers
<u>Melville</u>			
Morris Tronrud Jr.	Less than 3 MMBF	PP	1" boards Rough Part Time Sawmill

Table 100.

(Page 3)

<u>COMPANY</u>	<u>ANNUAL PRODUCTION</u>	<u>SPECIES PROCESSED</u>	<u>PRODUCTS MANUFACTURED</u>
TETON COUNTY			
<u>Choteau</u> Chuck Blixrud	Less than 3 MMBF	DF LPP ES	Part Time Sawmill
Weatherwell Lumber Co.	Less than 3 MMBF		Rough 1" boards
TREASURE COUNTY			
<u>Hysham</u> Joe Lind Sawmill	Less than 3 MMBF	PP Cottonwood	Dimension 1" boards Timbers Rough
WHEATLAND COUNTY			
<u>Judith Gap</u> Spring Creek Forest Products	5 - 10 MMBF		Studs Ties
YELLOWSTONE COUNTY			
<u>Custer</u> Botts Sawmill			
<u>Laurel</u> Perry Roderick Sawmill	Less than 3 MMBF	PP	1" boards Rough Part Time Sawmill

Table 101. Post and pole processors in Working Circles 4, 5, 6, 7, and 8.

<u>COMPANY</u>	<u>PROCESS USED</u>	<u>PRESERVATIVE USED</u>	<u>PRODUCTS MANUFACTURED</u>
FERGUS COUNTY			
<u>Lewistown</u> Lemmon Post & Pole		Penta	Posts, Poles, Lumber, Ties, Timbers
GLACIER COUNTY			
<u>Browning</u> Evans Enterprises	Cold soak- non-pressure	Penta-oil born	
HILL COUNTY			
<u>Box Elder</u> Rocky Boy Forest Products Enterprises			
JUDITH BASIN COUNTY			
<u>Stanford</u> Glassco Lumber	Cold soak- non-pressure	Penta-oil born	Posts, Poles, Lumber, Timbers
Terry Cleaver Posts			
MUSSELSHELL COUNTY			
<u>Roundup</u> Gebhardt Post Plant			
STILLWATER COUNTY			
<u>Reedpoint</u> Steve Kaplin			Posts
TETON COUNTY			
<u>Choteau</u> Bouma Post Yards	Pressure, Cold soak- non-pressure	CCA, Penta-oil born	Posts, Poles, Lumber, Ties, Timbers
WHEATLAND COUNTY			
<u>Harlowton</u> Marlo Post & Pole	Cold soak- non-pressure	Penta-oil born	Posts, Poles
YELLOWSTONE COUNTY			
<u>Laurel</u> Perry Roderick	Thermal- non-pressure	Penta-oil born	Posts, Poles

APPENDIX 5. DESCRIPTION OF TREATMENT CODES

The purpose of this appendix is to define the stand characteristics which make up each of the fourteen categories. In many cases, a stand may receive more than one treatment code. Under each treatment code description below there is a list of the other codes which may occur in combination with the one being described.

Code 10: Harvest - high risk

Code 10 includes all commercial, non-vigorous, overmature stands, as well as any merchantable stand which exhibits an unmanageable insect or disease problem.

Lodgepole sawtimber stands which are over 100 years old are automatically included.

Possible combinations: None

Code 11: Harvest - low risk

This is a diverse category which includes the following types of stands:

1. All commercial stands older than 100 years which do not qualify as high risk (they are of relatively better vigor than high risk stands). If such a stand is dominated by shade tolerant species, it is included here, regardless of age.
2. All commercial lodgepole stands which are 50-100 years old and non-vigorous, and which have not qualified as high risk.
3. Various other stands containing commercial material which are not manageable because of poor tree quality and vigor.

Possible combinations: None

Code 12: Commercial thinning

This category includes stands which are fully stocked to overstocked with Douglas-fir, western larch, ponderosa or lodgepole pine, and which meet all of the following characteristics:

1. Would yield commercial sawtimber if thinned.
2. Are less than 100 years old.
3. Are currently growing at less than full potential, but are capable of release.
4. Do not exhibit unmanageable insect or disease problems.

Possible combinations: (12, 13), (12, 13, 22), (12, 22).

Code 13: Overstory removal

Code 13 includes any stand which contains commercial size trees in excess of 1,000 board feet per acre, and which also meets one of the following conditions:

1. The trees in question are relicts, i.e., not part of the manageable stand component.
2. The trees in question represent the upper story of a two storied stand, but they are inadequately stocked to be treated as a separate management component.

Possible combinations: (13, 22, 33), (12, 13), (12, 13, 22), (13, 33), (13, 22), (13, 22, 23), (13, 20), (13, 20, 23), (13, 20, 22, 23), (13, 23), (13, 21).

Code 14: Two storied stand (overstory, harvest - high risk; understory, manageable)

This category is made up of two storied sawtimber stands meeting the requirements of treatment code 10. The following conditions also exist:

1. The overstory has a crown density of 10-50%.
2. One or more of the following treatment codes is indicated for the understory: 12, 20, 22, 30, or 33.

Code 15: Two storied stand (overstory, harvest - low risk; understory, manageable)

Two storied sawtimber stands meeting the requirements of treatment code 11, plus the following conditions, are assigned this code:

1. The overstory has a crown density of 10-50%.
2. One or more of the following treatment codes is indicated for the understory: 12, 20, 22, 30, or 33.

Code 20: Precommercial thinning

There are two general types of stands which qualify for precommercial thinning. These are:

1. Seedling and/or sapling stands which contain a manageable component of desirable or acceptable crop trees, but which will suffer growth loss from competition prior to reaching merchantable size, if stocking is not reduced.
2. Sapling to pole-size Douglas-fir, western larch, ponderosa or lodgepole pine which meet all of the following characteristics:
 - a. Stand is currently growing at less than full potential because of competition.

- b. There is a fully stocked, manageable component which is capable of release.
- c. Thinning would not yield merchantable material, and would not involve the felling of near-merchantable trees.

Possible combinations: (13, 20), (13, 20, 23), (20, 23), (13, 20, 22, 23), (20, 22, 23), (13, 20, 22), (20, 22).

Code 21: Stand conversion

This treatment code automatically implies the need for regeneration, following conversion.

Stands which qualify for this category include all precommercial stands which have unmanageable insect or disease problems. Also included are non-vigorous precommercial stands which would not be capable of release, if thinned. In the case of lodgepole pine, it includes all non-vigorous stands which are older than 50 years.

Seedling and sapling stands which are grossly understocked with crop trees, but which contain a significant stocking of undesirable (excess) trees, are also included under this category.

Possible combinations: (13, 21).

Code 22: Sanitation

This code applies to all crop stands whose health can be improved through intermediate cuttings, i.e., cuttings which reduce the source of the insect or disease problem (not applicable for most defoliating insect problems).

This category does not include stands which are in need of commercial harvest or precommercial stand conversion because of insects or disease, low vigor, or stagnation. It applies only to stands which can be sanitized and managed as a crop stand.

Possible combinations: (13, 22, 33), (22, 33), (12, 13, 22), (12, 22), (13, 22), (13, 22, 23), (22, 23), (13, 20, 22), (20, 22), (13, 20, 22, 23), (20, 22, 23).

Code 23: Regeneration of understocked areas

Code 23 includes all precommercial stands which are inadequately stocked with desirable or acceptable crop trees. The minimum standard for adequate crop tree stocking is 210 trees per acre, with at least 70% of the area stocked.

This code by no means implies a particular method of regenerating understocked areas. Under code 23, options may exist for use of existing seed sources, site preparation, planting, direct seeding, or combinations of these methods. In many cases, this treatment code represents situations where the stocking of undesirable excess trees must be reduced prior to supplementing the existing understocked crop stand with additional regeneration. In such cases, this treatment would occur in combination with precommercial thinning (code 20).

It should also be noted that regeneration needs which are associated with stand conversion (code 21) are separate from those under code 23.

Possible combinations: (13, 22, 23), (22, 23), (13, 20, 23), (20, 23), (13, 20, 22, 23), (20, 22, 23), (13, 23).

Code 30: No treatment due to productive condition

Stands in this category are adequately stocked with productive crop trees for timber management purposes. In the case of very young stands, stocking of undesirable (excess) competition is minimal, and should not impact growth rates on crop trees before merchantable size is attained. In the case of large sapling to small sawtimber stands, the crop trees are currently growing at or near full potential for their age and the site, and are expected to continue to do so for several years.

There are no significant insect or disease problems associated with stands in this category, with the possible exception of defoliators which have not affected the manageability of the stand.

Possible combinations: None

Code 32: No treatment - Inoperable

This category includes all stands on sites which are considered inoperable, using current, conventional Montana logging systems (balloon and helicopter systems are not considered conventional in Montana).

Generally, slopes steeper than 80% are considered inoperable at the present time. Other inoperable situations include very rocky areas, where road building and logging might be difficult, or an otherwise operable site which has no operable access routes.

This code is not assigned using the key, but is based on field observations.

Code 33: No treatment - Defer until merchantable

Code 33 includes poletimber to small sawtimber size stands of trees whose growth rates could be improved through thinning, but not without the loss of near-merchantable material. Because growth rates and tree quality are acceptable (but not optimal), stands in this category are deferred from treatment until the stand emerges into a size class where commercial treatment options exist. However, stands in this category may qualify for overstory removal (code 13) and/or sanitation (code 22), even though the crop stand has been deferred from thinning. In other words, the "No treatment" label applies only to the main stand component.

Possible combinations: (13, 22, 33), (22, 33), (13, 33).

Code 40: Unknown - Poor crowns, good growth

This is a fairly unique but well defined category for which the data compiled in the stand treatment analysis does not provide enough information to make a logical decision.

All stands under code 40 possess the following characteristics:

1. Fully stocked Douglas-fir, western larch, or ponderosa pine saplings, poles, or small sawtimber.
2. Growth rates at or near full potential.
3. Poor crown ratios (less than 30%).
4. No unmanageable insect or disease problems.

The problem in this situation is that the compiled data fails to explain why a stand would have poor crown ratios, but also good growth rates during the last ten (10) years. Have crowns recently become suppressed from competition? In this case, the next ten years' growth might be much lower. Or, has this stand been released during the last ten years? In this case, the crown ratios may be improving, even though they are presently unacceptable.

Because the data summary does not answer the above questions, the treatment opportunities are not logically defined for such a stand.

Possible combinations: None

Table 102. Treatment opportunity code definitions.

10 Harvest - high risk
11 Harvest - low risk
12 Commercial thinning
13 Overstory removal
14 Two storied stand (overstory, harvest - high risk; understory, manageable)
15 Two storied stand (overstory, harvest - low risk; understory, manageable)
20 Precommercial thinning
21 Stand conversion
22 Sanitation
23 Regeneration of understocked areas
30 No treatment due to productive condition
32 No treatment - inoperable
33 No treatment - deferred until merchantable
40 Unknown - poor crowns, good growth

No Overlap

12, 13 Commercial thinning, overstory removal
13, 20 Overstory removal, precommercial thinning
13, 20, 23 Overstory removal, precommercial thinning, regeneration of understocked areas
13, 21 Overstory removal, stand conversion
13, 23 Overstory removal, regeneration of understocked areas
13, 33 Overstory removal, no treatment - deferred until merchantable
20, 23 Precommercial thinning, regeneration of understocked areas
22, 23 Sanitation, regeneration of understocked areas
22, 33 Sanitation, no treatment - deferred until merchantable

Possible Overlap

12, 13, 22 Commercial thinning, overstory removal, sanitation
12, 22 Commercial thinning, sanitation
13, 20, 22 Overstory removal, precommercial thinning, sanitation
13, 20, 22, 23 Overstory removal, precommercial thinning, sanitation, regeneration of understocked areas
13, 22 Overstory removal, sanitation
13, 22, 23 Overstory removal, sanitation, regeneration of understocked areas
13, 22, 33 Overstory removal, sanitation, no treatment - deferred until merchantable
20, 22 Precommercial thinning, sanitation
20, 22, 23 Precommercial thinning, sanitation, regeneration of understocked areas

APPENDIX 5. LOCATION RECORD SHEET AND TREE DATA SHEET

LOCATION RECORD SHEET

LOCATION DESCRIPTION		AREA CLASSIFICATION			ARFA DESCRIPTION			OPTIONS				
STATE	1/2	3/0	WORKING CIRCLE	0/8	1/4	2/2	3/4	4/6	5/4	6/2	7/3	
UTAH	1/2	3/0	WORKING CIRCLE	0/8	1/4	2/2	3/4	4/6	5/4	6/2	7/3	
DATE SURVEY	COUNTY	UTM COORD	ESTATE	UTM COORD	ELVATION	USE	LAND USE	P/LAND	STAND DISTN	ASPECT/SLOPE	CLASS	
CONVENTIONAL U.T.M. NAD 1983												
12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3	12 9 9 0 9 7 2 5 6 5 0 5 0 4 7 0 1 0 9 8 0 0 5 4 2 0 1 5 1 7 3 1 1 1 1 2 3 3 3 2 2 0 3 3

LOCATION INFORMATION

REFERENCE POINT	SP 202	TEN POINT LAYOUT	COURSE TO SAMPLE LOCATION (Slope): iZ 67° DIST. 210
DBH 16.0	3. + 3. edge of spr.	WITNESS TREES	X SP 202 DBH 8.4 AZ 76 DIST. 31.5 Y SP 113 DBH 8.1 AZ 311 DIST. 5.6
STANUS BY ITSELF ON AN OPEN, HARSH (NO VEGETATION)	4. + 4. + 4. + 4. + 4. + 4. + 4. + 4. + 4. + 4. + 4. + 4.	FIELD CREW	ESTIMATOR RUPKALVIS
GENERAL STATEMENT	5. + 5. + 5. + 5. + 5. + 5. + 5. + 5. + 5. + 5. + 5. + 5.	RECODER HANNAH	PHOTOS SWEET GRASS ASCS 1965 PROJECT DWX ROLL 4 FF PHOTO NOS. 118, 119
STARTING AT THE TURNOFF FOR MULCOW ON HIGHWAY 192 SOUTH OF BIG TIMBER, CONTINUE SWING ON 29E FOR 3 4 MILES. TURN LEFT ON "EAST BULLER CREEK ROAD" AND GO 3.7 MILES. TURN RIGHT ON THE "EAST BULLER CREEK ROAD" AND GO 1.3 MILES. TURN RIGHT THRU A GATE AND FOLLOW A RANCH ROAD FIRST UPHILL THRU A FIELD AND THEN UP A DRAINAGE FOR 3 MILES. WHEN THE MAIN RCAI CURVES TO THE LEFT, FOLLOW AND CLEVER ROAD STRAIGHT 100-200 YDS OVER THE SADDLE TO A GATE. GO THRU THE GATE AND DOWN THIS ROAD (4-WHEEL DRIVE HELPFUL) FOR .5 MILE. RIN + PLOT ARE ACROSS THE DRAINAGE TO THE RIGHT.	7. + 7. + 7. + 7. + 7. + 7. + 7. + 7. + 7. + 7. + 7. + 7.	FIELD EDIT NAME DATE MONTH/MON/TYEAR	OFFICE EDIT NAME DATE MONTH/DAY/YEAR
USGS topo. MAP NAME MERIDIAN BASIN	MAP NO. 2626	DECLINATION 0° E.A.P. 42	DECLINATION 0° E.A.P. 42
		TOWNSHIP 35 RANGE 18 SECTION	FUEL # 23

TREE DATA SHEET

STATE	4 2 5 0	WORKING	CIRCLE	7	LOCATION	3 1 5
DATE	22 SEP 1980			5 5 7		

APPENDIX 7. FOREST LAND GRAZING DATA SHEET AND SAMPLE
SCS GRAZING GUIDE

MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
DIVISION OF FORESTRY

WOODLAND RANGE FORAGE CONDITION RECORD

Location 1-1 Crew 21117 - KUN-6LVS
County 1-1 Date 9/17/75
Working Circle 1 State Forest _____

Species	Column A Present Percent Composition by Wt.	Column B Present Percent Composition Allowed			
DECREASERS:					
MULBERRY	30	35			
INCREASERS:					
AHO FESCUE	40	10			
SNOWSKIRT	5	5			
FOD. INC.	20	10			
INVADERS:					
TIMOTHY	5	—			
Percent Composition	100%	55 %			
Condition Class Rating	XXXX	G O Condition			
Guide Sheet	Precipitation Zone				
Crown Density	10-30	30-50	50-70	70+	Circle One
Soil Depth	Deep and Moderately Deep (20")	Very Shallow (10")	Shallow and Coarse		
Greater Effective Moisture	YES	(NO)			
REMARKS:	33/0	WT			

FIG. I. ECOLOGICAL POSITION OF INDIVIDUAL SPECIES IN THE CLIMAX UNDERSTORY AND RESPONSE TO GRAZING BY CATTLE.

DECREASERS /1	INCREASERS /2	Maximum Percent Dry Weight Produced Annually in Excellent Condition*					
		Deep & Moderately Deep Soils		Shallow Soils (10 ⁱⁿ to 20 ⁱⁿ)		Tree Crown Cover Percent	
		Crown Cover Percent	10-30 30-50	10-30 30-50	10-30 30-50	10-30 30-50	10-30 30-50
Alpine timothy	Balsamroot	5	-	-	-	10	-
Basin wildrye	Lambs fescue	10	10	-	-	15	15
Bearded wheatgrass	Lupine	10	-	-	-	5	-
Blue wildrye	Pinegrass	15	d	d	d	10	d
Bluebunch wheatgrass	Wheatgrass	10	10	5	5	5	-
Columbia needlegrass	Other forb inc.**	5	10	5	5	5	5
Elk sedge	Timber danthronia	5	-	-	-	10	-
Hawkweed	Juniper	-	5	-	-	10	-
Montana wheatgrass	Oregongrape	-	5	5	-	-	-
Mountain brome	Other woody inc.***	5	10	15	-	5	15
Nodding brome	Russet buffaloberry	-	15	10	-	5	10
Other forb dec.	Sagebrush	5	-	-	-	-	-
Purple reedgrass	Snowberry	5	15	25	-	10	15
Richardson's needlegrass	White spiraea	5	5	10	-	5	10
Rocky Mountain maple							
Rough fescue							
Scoulerleaf ricegrass							
Edge decreasers							
Slender wheatgrass							
Spire fescue							
Spike trisetum							
Sticky geranium							
Tufted hairgrass							
Western fescue							
Bitterbrush							
Dwarf huckleberry							
Serviceberry							

*The symbol "-" means the species (b) weight) is less than 25% of the composition.

**Other forb increasers may be: anemone, beechstraw, puccas, strawberry, tall larkspur, western yarrow

***Woody increases may include: currants, gooseberries, rose, kinnikinnick, snowbrush, ceanothus.

The symbol "d" denotes that species reacts as a decreaser in the instance indicated.

Spire trisetum
Sticky geranium
Tufted hairgrass
Western fescue
Bitterbrush
Dwarf huckleberry
Serviceberry

PART II. GUIDE FOR MAKING RECOMMENDATION ON STOCKING.*

SOIL	PRESENT FORAGE VALUE IN PERCENT OF POTENTIAL					
	EXCELLENT		50%		POOR	
	Crown Cover Percent	10-30 30-50 50-70	Crown Cover Percent	10-30 30-50 50-70	Crown Cover Percent	10-30 30-50 50-70
Deep & moderately deep	.5	.35 .2 .1	.35 .2 .15	.25 .15 .1	.1 .05 .1	.05 .1 .05
Shallow & coarse	.4	.25 .1 .3	.15 .15 .15	.2 .1 .1	.10 .10 .10	-. -. -. -

*Where beargrass, huckleberry and twinflower are conspicuous forest understory components reduce stocking values in Fort 11 25%.

All utilization cuts due to adverse accessibility are to be applied to grazing unit after AUM's are summarized.

/1 Climax species that decrease with grazing pressure by cattle. No limit to amount in climax.

2/ Climax species that increase with grazing pressure by cattle.

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GLOSSARY

Acceptable tree

Growing-stock tree of commercial species that does not qualify as a desirable tree.

Access

The degree to which the range will be utilized. The factors affecting grazability are slope, miles to the nearest stream, trails and roads in the area, water developments, brush, slash, rocks and mechanical barriers.

Accretion

Annual increase in net volume of trees in a size class, and the increase in net volume of trees after reaching a measured size class during the year.

Allowable cut

The volume of timber that would be cut on commercial forest land during a given period under specified management plans for sustained production such as those in effect on national forests.

Animal Unit

One mature (1,000 pound) cow with or without an unweaned calf, or the equivalent. A mature bull is 1.3 animal units, a mature horse is 1.25 animal units, a mature sheep is 0.2 of an animal unit, a mature elk is 0.7 of an animal unit, and a mature deer is 0.2 of an animal unit.

Animal unit month

The amount of forage required by an animal unit for one month.

Area condition class

A classification of commercial forest land based upon stocking by desirable trees and other conditions affecting current and prospective timber growth.

Basal area

A measure of square feet of space occupied by the stem of a tree. This measurement is made at breast height.

Basal area factor

The basal or stem area per unit of stand area for a given angle for each tree intercepted from a given point.

Basal area standard

Sixty percent of normal basal area usually for trees 0.6 inches d.b.h. and larger.

Bureau of Land Management lands

Federal land administered by the USDI Bureau of Land Management.

Census water

Water areas of more than 40 acres and water courses more than 1/8 mile wide.

Climax series

A group of habitat types that at climax will be dominated by the same tree species.

Commercial species

Tree species presently or prospectively suitable for industrial wood products.

Commercial thinning

A thinning in which the cut trees are large enough to be removed and utilized, regardless of whether their sale offsets the cost of the thinning.

Commercial timberland

Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as productive forest land have the capability of producing in excess of 20 ft³/acre/year of industrial wood under management. Currently inaccessible and inoperable areas are included, except where the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future).

Condition class

A method of expressing the general health of the range by comparing the expected percentage of the climax composition contributed by each species to the actual composition. No invaders (plants present only because of a disturbance, such as grazing) are counted and only the amount of increasers (plants that increase under grazing pressure) that would be present at climax are included. All of the decreasers (plants that decrease under grazing pressure) are counted.

County and municipal lands

Lands owned by counties and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

Crown class

A classification of trees based on dominance in relation to adjacent trees in the stand as indicated by crown development and amount of light received from above and the sides.

Crown density

The percentage of the forest floor that is covered by tree crowns. Forest land with greater than 70% crown density is considered to have no range value for livestock.

Cull

Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Decreaser (decreasing range plant)

Plants which decrease under heavy grazing pressure. These are usually the more palatable plants and the ones that the livestock prefer to eat.

Diameter breast height (d.b.h.)

The diameter of a tree at a point 4½ feet above the ground on the tree's uphill side. Height of d.b.h. may vary on abnormally formed trees.

Desirable tree

Live noncull trees of commercial species are divided into two classes: desirable and acceptable. For a tree to be desirable it must be free from disease, of good form, potentially not more than 10 percent defect of disease or fire scar, of good vigor, and not excessively limby if sawtimber. A tree will be considered to have good vigor if it has 40 percent or more crown (exception: ponderosa pine, and aspen may have only 30 percent crown to be classed as desirable). It is the kind of tree that would be favored in cultural operations or featured in management in under rotation-age stands. Mature trees (over rotation age) of commercial size with less than 20 percent defect and expected to live 10 years are low-risk trees and may also be classed as desirable trees. A species which is not adapted to the site should be classified as sound cull.

Diameter Classes

A classification of trees based on diameter outside bark, measured at breast height (4½ feet above the ground). Note: D.b.h.. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch of the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h., inclusive).

Farmer-rancher lands

Lands owned by individuals with a minimum of 40 acres.

Fish, Wildlife, and Parks Land

Land administered by the Montana Department of Fish, Wildlife, and Parks.

Fixed radius plot

For this inventory a 1/300 acre (6.8 feet radius), circular plot, located at each sample point on which live trees up to 4.99 inches d.b.h. are tallied.

Forest industry

Lands owned by companies or individuals operating wood-using plants.

Forest land

Land at least 16.7 percent stocked by forest trees, or formerly having such tree cover, and not currently developed for nonforest use. Forest land does not include land currently developed for nonforest uses such as urban or thickly settled residential or resort areas, city parks, orchards, improved roads, or pasture lands improved by such measures as seeding or irrigation. The minimum area for classification of forest land is one acre. Roadside, streamside, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads, trails, streams, and clearings in forest areas are classed as forest land if they are less than 120 feet wide.

Forest types

A classification of forest land based upon the dominant species forming a plurality of stocking based on area occupied in the present tree cover.

Grazability

The degree to which the range will be utilized. The factors affecting grazability are slope, miles to the nearest stream, trails and roads in the area, water developments, brush, slash, rocks and mechanical barriers.

Gross growth

Annual increase in net volume of trees in the absence of cutting and mortality. It includes ingrowth and accretion.

Growing-stock trees

Live trees of commercial species qualifying as desirable or acceptable trees. (Excludes rough, rotten, and dead trees.)

Growing stock volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees (all trees 5.0 inches d.b.h. and larger) from stump to a minimum 4.0 inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

Habitat type

An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Hardwoods

Dicotyledonous trees, usually board-leaved and deciduous.

Increaser (increasing range plant)

Plants which increase under heavy grazing pressure. These are usually less palatable plants.

Indian lands

Tribal lands held in fee by the Federal Government, but administered for Indian tribal groups and Indian trust allotments.

Ingrowth

The number or net volume of trees that grow large enough during a specified year to qualify as saplings, pole timber, or sawtimber. The measurement is at the size of entry into the size class.

Inoperable stand

Any stand on a site that is considered inoperable using current, conventional Montana logging systems (balloon and helicopter systems are not considered conventional in Montana). A more detailed explanation is given under treatment code 32 in Appendix 5.

Invader (invading range plant)

Plants that are not part of the climax cover but which invade under heavy grazing pressure. Few invaders are preferred by livestock and many are worthless.

Land use influence zones

Zones delineated around areas or regions where it is likely that other nontimber uses or environmental constraints would have an impact on availability of timber.

Mean annual increment

A measure of the volume of wood, in cubic feet, produced on 1 acre during 1 year. Forest Survey minimum standard for commercial forest land is the ability to produce 20 ft³/acre/year.

Miscellaneous federal

Federal lands other than national forest lands, lands administered by the USDI Bureau of Land Management, or Indian lands.

Mortality

Number of sound-wood volume of growing stock trees dying from natural causes during a specified period.

Mortality tree

A tree of commercial species, 5.0 inches d.b.h., or larger standing or down, that has died within the past 5 years and was not a cull tree at the time of death.

National forest land

Federal lands which have been designated by executive order or statute as national forests or purchase units and other lands under the administration of the USDA Forest Service, including experimental areas.

Net annual growth

The increase in net volume of a specified size class for a specific year. (Note: Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to its end, plus net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became rough or rotten trees during the year). Net growth figures in this publication when expressed as ft³/acre/year of growing stock are for all live growing stock trees 5.0 inches d.b.h. and larger.

Net volume

The gross volume of a tree less deductions for rot, sweep, or other defect affecting use for wood products.

Noncommercial forest land

Forest land incapable of producing 20 cubic feet per acre of industrial wood under management, because of adverse site conditions, includes only nonreserved forest land.

Noncommercial species

Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. It includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width and 1 to 40 acres of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size to qualify as nonforest land.

Nonsalvable dead

Dead trees 5.0 inches d.b.h. and larger, standing and down, and less than 50 percent sound on a cubic-foot basis.

Firm rotten Tree is less than 50 percent sound on a cubic-foot basis. More than half the total volume loss is due to rot and less than half is due to such defects as excessive sweep and crook. Tree or potential product sections are firm enough to hold together if handled.

Crumbly rotten Tree is less than 50 percent sound on a cubic-foot basis. More than half the total volume loss is due to rot and less than half is due to such defects as excessive sweep and crook. Tree or potential product sections will not hold together if handled.

Nonstockable

Areas of forest land not capable of supporting seedlings of commercial species because of the presence of rock, water, roads, etc.

Nonstocked land

Commercial forest land less than 16.7 percent stocked with growing stock trees.

Normal basal area

The basal area at which all growing space is effectively occupied but having ample room for development of the crop trees.

Old-growth sawtimber stands

Sawtimber stands in which 50 percent or more of the area is occupied by old-growth sawtimber trees.

Other forest land

See noncommercial forest land.

Other private corporate

Land owned by corporations not in the forest industry.

Other private individual

Lands smaller than 40 acres owned by individuals.

Other private ownership group

The ownership group that consists of land owned by farmers, ranchers, miscellaneous private corporations, and miscellaneous private individuals.

Other state lands

State land other than state forests, land board, and Fish, Wildlife, and Parks.

Ownership class

The finest level of ownership used in this report. The classes are: miscellaneous federal, Department of State Lands-Classified Forest Land and Classified Grazing Land, county and municipal, Montana Department of Fish, Wildlife and Parks, other state, forest industry, farmer-rancher, other private corporate, and other private individual.

Ownership group

Convenient groups of ownership classes. The groups are: State and other public, forest industry, and other private.

Poletimber stands

Stands at least 16.7 percent stocked with growing stock trees of which 50 percent or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Poletimber trees

Trees at least 5.0 inches in diameter at breast height but smaller than 9.0 inches for softwoods and 11.0 inches for hardwoods.

Potential growth

Or yield capability is defined as mean annual increment of growing stock attainable in fully stocked natural stands at the age of culmination of mean annual increment. When expressed in cubic feet of growing stock, unless specified otherwise, the volume figure includes all surviving live trees 1.0 inches d.b.h. and larger, for most tree species. See Brickell (1970) for further information.

Precommercial thinning

A thinning in which the cut trees are too small to be removed and utilized.

Productive-reserved forest land

Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas-tree production.

Rotation

The period of years between establishment of a stand of timber and the time when it is considered ready for cutting regeneration.

Rotten trees

Live trees of commercial species that do not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8 feet long or longer, now or prospectively and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees

- (1) Live trees of commercial species that do not contain at least one 12-foot sawlog or two noncontiguous sawlogs, each 8 feet long or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form.
- (2) All live trees of noncommercial species.

Salvable dead

Standing and down dead trees 5.0 inches d.b.h. and larger and more than 50 percent sound on a cubic foot basis.

No defect Tree has no rot, and no defect such as excessive sweep and crook.

Defect-mostly physical Tree is more than 50 percent sound on a cubic-foot basis. Less than half the total volume loss is due to rot and more than half is due to such defects as excessive sweep and crook.

Defect-mostly rot Tree is more than 50 percent sound on a cubic-foot basis. More than half of the total volume loss is due to rot and less than half is due to such defects as excessive sweep and crook. Tree or potential product sections are firm enough to hold together if handled.

Sanitation

Improving the health of a stand through intermediate cuttings which reduce the source of the insect or disease problem.

Saplings

Trees 1.0 inches to 4.0 inches in diameter at breast height.

Sawlog

A section of a tree stem of sufficient size to yield commercial size dimension lumber.

Sawtimber trees

Softwood trees which are 9.0 inches and larger and hardwood trees which are 11.0 inches and larger in diameter at breast height.

Sawtimber volume

Net volume in board feet of sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner Rule

The common board-foot log rule used in determining volume of sawtimber in the Western states.

Seedlings

Live trees less than 1.0 inch in diameter at breast height.

Seedling-sapling stands

Stands at least 16.7 percent stocked with growing stock trees in which more than half of the stocking is saplings and/or seedlings.

Site Class

A classification of forest land in terms of inherent capacity to grow crops of industrial wood. Site classifications are based upon the mean annual growth of growing stock (not including thinnings) attainable in fully stocked stands at culmination of mean annual growth. Height-age relationships are usually used as indicators of the specified volume-site class.

Site index class

A measure of site productivity based upon the height of trees at a given base age. Site index classes are height classes represented by a graphed curve of height over age for each class.

Site trees

Trees measured for height and age, used to estimate site index.

Softwoods

Coniferous trees, usually evergreen, having needle or scale-like leaves.

Stand density

A quantitative measure of a stand in terms of square feet of basal area, number of trees, or volume per acre. It reflects the degree of crowding of stems within the area.

Stand-size class

A classification of forest land based on the class of growing stock trees on the area, that is, sawtimber, pole timber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent of stocking at a plot point, based upon a 10-point location, will be considered in determining stand-size class).

State and other public ownership group

The ownership group that consists of state, county, municipal, and miscellaneous federal land.

State forest

Lands administered by the Department of State Lands that are managed as a unit.

State forest land

State owned land that is principally valuable for forest and watershed cover that is classified as forest and administered by the Department of State Lands.

State grazing land

State owned land that is principally valuable for forage production that is classified as grazing and administered by the Department of State Lands.

Stocking

Stocking is an effort to express the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full

stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit of full stocking has been set at 133 percent. Sites with less than 100-percent stocking represent under-stocking with less than full site occupancy. Over-stocking is characterized by sites that have over 133 percent stocking.

Tertiary deposits

Rock and materials deposited in the period of geologic time previous to the current period, which ran from about 65 million to about 2.5 million years ago.

Tree class

A classification assigned to each live tree based on such physical characteristics as surface and internal defects, relative pole length, crown ratio and position, and damage sustained by the tree. (See also desirable tree, acceptable tree, rough tree, and rotten tree).

Tree size class

A classification of trees primarily according to diameter at breast height outside bark, including sawtimber trees, pole timber trees, saplings, and seedlings.

Unproductive forest land

Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions, because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness).

Variable radius plot

A plot on which a predetermined critical angle is projected from a central point, and swept in a full circle, to determine the basal area, tree count, and volume per unit of area. The radius of this plot is a function of tree basal area and is therefore variable.

Young-growth sawtimber stands

Sawtimber stands in which 50 percent or more of the stand is occupied by young-growth sawtimber trees.

Young-growth sawtimber trees

Sawtimber trees less than 100 years old.

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